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Vol. 29 AUGUST, 1946 No. 2

# THE JOURNAL OF PEDIATRICS

A MONTHLY JOURNAL DEVOTED TO THE PROBLEMS AND DISEASES OF INFANCY AND CHILDHOOD

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Official Organ for
THE AMERICAN ACADEMY OF PEDIATRICS

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TABLE OF CONTENTS ON 3rd COVER

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The Journal of Pediatrics

VOL. 29 AUGUST, 1946 No. 2

## Original Communications

# MUMPS: TECHNIQUES OF LABORATORY DIAGNOSIS, TESTS FOR SUSCEPTIBILITY, AND EXPERIMENTS ON SPECIFIC PROPHYLAXIS

JOHN F. ENDERS, M.D.
BOSTON, MASS.

THE characteristic parotitis and orchitis of mumps have been known to physicians for two thousand years. Meningoencephalitis, pancreatitis, ovaritis, as well as auditory and ocular disturbances—the other most important manifestations of this viral infection—much later received recognition. Together with orchitis these so-called complications not only represent the more serious features, but would also seem to provide the diagnostician, the student of viruses, and the immunologist with problems of great interest.

In view of the well-established background of clinical knowledge, it is rather surprising that investigators have largely neglected this ancient disease—a disease which, because of its ubiquity and comparative benignity, may be regarded as an exceptionally favorable object for experimental study, both in the laboratory animal and in man. Indeed it is only twelve years ago that Johnson and Goodpasture[1] conclusively demonstrated the nature of the etiologic agent. These workers produced typical parotitis in Rhesus monkeys by inoculating them with saliva from patients. In this way the essential tool for further study of the virus was made available. The susceptibility of this monkey has been substantiated by groups of investigators in this country, in England, and in Australia[2, 3, 4]. Until very recently, however, no other species except man and the monkey had been found to be susceptible. This fact somewhat retarded progress in the systematic and detailed study of the factors in immunity although a good deal was learned from experiments which have been carried out in these two hosts. About a year ago, however, Habel[5] succeeded, as did we,[6] in propagating the virus in the developing hen's egg. In our laboratory, thus far, one strain of virus has been carried through thirty-seven serial passages in this medium; and it is now apparent that we are in possession of a simple, convenient, and inexpensive method for producing unlimited quantities of infected material. This discovery has already led to a rapid accumulation of new information concerning the properties of the virus.

Presented before the Meeting of Region I, American Academy of Pediatrics, New York, N. Y., April 2-4, 1946.

Three developments have arisen from investigations made possible by these basic techniques which offer some promise of being of assistance to the practicing physician. The first is the application of the complement fixation test to the diagnosis of mumps infections and to the differential diagnosis of the clinical syndrome of aseptic, or as it is sometimes called lymphocytic, meningoencephalitis.[7, 8] The second development includes experiments on the significance of the allergic response which follows the intradermal inoculation of small quantities of heat-inactivated virus into the skin.[9, 10] The third concerns the results of studies not yet completed which have been directed toward the development or evaluation of certain specific prophylactic agents.[10, 11]

The technique of complement fixation has been used more and more frequently during the last ten to fifteen years in the diagnosis of viral infections. Therefore, when we were able to confirm the observation that the monkey could be easily infected with mumps virus, it seemed probable that following the subsidence of the acute symptoms, complement fixing antibody might appear in the circulating blood. The extensive involvement of the parotid gland likewise suggested that this tissue might contain sufficient quantities of virus to provide an antigen which could be employed in complement fixation tests. These ideas were tested experimentally and they were immediately verified. It was shown that the sera of normal monkeys or specimens taken during the acute phase of the disease do not fix complement in the presence of a suspension of the infected parotid gland. In contrast, the serum taken from three to five days after the swelling subsides strongly fixes complement. As an example of these immunologic events, the results of successive tests in one animal are presented in Table I. Examination of specimens of acute and convalescent sera from 130 cases of typical epidemic parotitis in man has made it clear that specific complement fixing antibody emerges regularly during convalescence. This fact is illustrated in Table II where the results of tests on pairs of acute and convalescent sera obtained from 8 cases of parotitis are summarized. We have so far encountered no individual in whom the clinical diagnosis was unequivocal who has not responded in this manner. Accordingly we may conclude that when the appearance of antibody or its increase in concentration can be demonstrated, infection with the virus has recently occurred.

As with other serologic methods, the results of this test in mumps can only be regarded as conclusive when two specimens of serum taken at suitable

TABLE I. DEVELOPMENT OF COMPLEMENT FIXING ANTIBODY IN THE MONKEY. INOCULATED 12/31/45

| DATE BLED | COMPLEMENT FIXATION TITER |
|---|---|
| 12/31/45 | 0 |
| 1/3/46 | 0 |
| 1/5/46 | 0 |
| 1/8/46 | 0 |
| 1/10/46 | 0 |
| 1/12/46 | 1:384 |
| 1/14/46 | 1:768 |
| 2/5/46 | 1:384 |

TABLE II. COMPLEMENT FIXATION—MUMPS PAROTITIS

| PATIENT | FIRST BLEEDING (DAYS AFTER ONSET) | TITER (ACUTE PHASE) | SECOND BLEEDING (DAYS AFTER ONSET) | TITER (CONVALESCENT PHASE) |
|---|---|---|---|---|
| F. C. | 0 | 0 | 17 | 1:192 |
| C. D. | 1 | 0 | 14 | 1:384 |
| W. G. | 0 | 0 | 19 | 1:384 |
| R. N. | 1 | 0 | 12 | 1:96 |
| B. T. | 0 | 0 | 7 | 1:384 |
| L. W. | 5 | 1:96 | 12 | 1:768 |
| S. K. | 1 | 0 | 4 | 1:96 |
| M. O. | 2 | 1:32 | 10 | 1:1,024 |

intervals are examined. The first specimen must be secured as soon as possible since it has been found that antibody may appear very rapidly after the appearance of symptoms. In many individuals the test becomes positive within five to seven days after the onset and in some cases even as early as the first or second day. By the fourteenth day nearly all convalescent sera which we have examined have shown high titers of antibody. Rarely a patient did not develop antibody until twenty-one days had elapsed. Therefore, if only two specimens are to be tested, the second should be taken at the end of the third week. But from these findings it is apparent that the serologic diagnosis can frequently be made within a week or less after symptoms have appeared and, in nearly all instances, after an interval of two weeks.

The antibody concentration usually begins to fall after six weeks to two months, although in isolated instances it may persist at an elevated level for longer periods. By the end of six months or a year, however, in nearly all cases, the antibody either has disappeared or has dropped to the relatively low levels charactertistic of many persons who have given a history of an attack at some time in the more or less remote past.

Although most of the results which are outlined have been obtained with monkey antigen, the development of the egg technique now furnishes a source of abundant complement fixing antigen which may be obtained at low cost in any well-equipped laboratory.

The behavior of this antibody has been described in some detail because the facts which have been established in unmistakable cases of mumps are of importance when the test is applied to the diagnosis of infections in which salivary gland involvement may be absent or so slight as to leave the observer in doubt. The syndrome of aseptic meningoencephalitis is an illustration of this type of infection. It is now well known that this condition has a varied etiology. In many instances the nature of the agent still remains obscure, but in others a variety of viruses have been incriminated. Identification of the specific virus cannot be made without recourse to laboratory aids, since all these agents may give rise, at least in the earlier stages, to symptoms which are similar and to cellular and chemical reactions in the spinal fluid which are essentially alike. Of the latter, the increase in lymphocytes is, of course, the most salient characteristic. Our findings, as well as the results of studies carried out at the Army Medical School by Plotz,[12] indicate that

among these viruses, that of mumps is very commonly involved. When there is an associated enlargement of the salivary glands or a clear-cut history of exposure to mumps, the presumptive differential diagnosis is not usually difficult. But when these data are absent, the observer may be left in doubt. Meningoencephalitis due to the virus of mumps but without involvement of the salivary glands or even a history of exposure is not infrequent.

By means of the fixation technique we have thus far tested sera and, in a few instances, the spinal fluids from more than one hundred cases of meningoencephalitis. In only 88 of them, however, were the materials taken at an appropriate time. Even among these 88 cases, specimens were often not obtained sufficiently early to enable us to demonstrate an increase of antibody. This was not always due to failure to take the specimen as early as possible, but to the fact that meningoencephalitis may be a late manifestation of infection, appearing after antibody formation has already begun. In consequence a high titer, i.e., 1:192* or over, may be found at the onset of encephalitis. Yet even when an increase cannot be demonstrated, such high titers under these circumstances may be regarded as *presumptive* evidence of recent infection, since it has been shown by many hundreds of tests in normal individuals that the titer is rarely 1:96 and has only once been found to exceed 1:192.

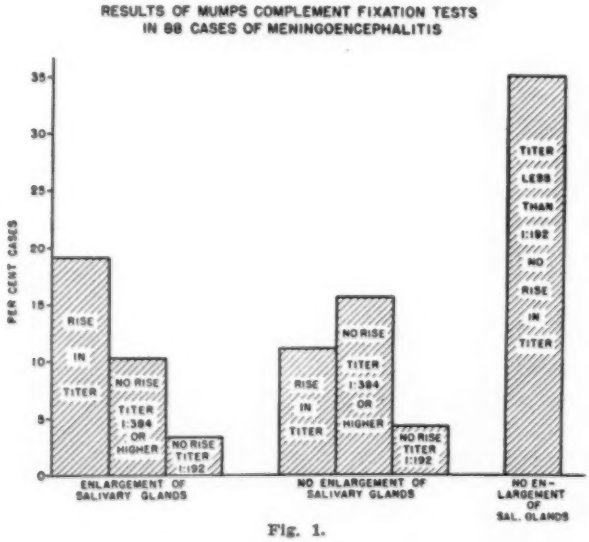


Fig. 1.

With these facts in mind, we may examine the results obtained in the 88 cases which are presented in Fig. 1. It is clear that on the basis of the serologic criteria just mentioned, roughly two thirds of them could be classified

*With the exception of the data included in Figs. 1, 2, and 3, titers are expressed in terms of the *final* dilution of serum before the addition of sensitized cells. In the technique which we have employed, this is equivalent to 3 times the initial dilution which is that more often reported. For a more complete discussion of the application of the complement fixation test to the diagnosis of meningoencephalitis, see reference.[5]

as presumptively or definitely (increase in antibody demonstrated) associated with a recent infection with the virus of mumps. But of these only about one-half presented signs of salivary gland involvement. This varied from frank parotitis to very questionable enlargement of a submaxillary or a sublingual gland.

When salivary gland involvement was entirely absent, a positive test afforded the only direct indication of the etiology, although in certain instances a clue was also given by a history of recent exposure. Conversely, because of the evidence for the specificity of the antibody response, it would also seem justifiable to conclude that the disease in those who showed neither an increase in antibody nor a high titer was not caused by the virus of mumps.

It is of interest to note that the clinical diagnosis made in these 88 cases included "benign aseptic meningoencephalitis," "mumps meningoencephalitis," poliomyelitis without paralysis, and lymphochoriomeningitis.

Tests for the presence of antibody in the spinal fluid were not usually done, but of 11 specimens which were examined, antibody was detected in only 3. These results show that although antibody may occasionally enter the spinal canal, it does this infrequently and so from a practical standpoint it would appear useless to test for it.

These various points may be emphasized by the findings in two cases due to mumps encephalitis which are presented in Figs. 2 and 3.* Fig. 2 shows the course of the disease in a 16-year-old boy whose case was diagnosed as typhoid fever on admission to the hospital because of high fever, low white count and slow pulse, and the fact that his spinal fluid was negative on admission. Shortly afterward signs of meningeal irritation were observed and the spinal fluid cell count rose to 270. When the temperature fell and some symptoms cleared, he developed a very slight orchitis and parotitis. The complement fixation test revealed a fourfold rise in antibody which is considered to be diagnostic. In Fig. 3 are summarized the salient features of meningoencephalitis in a 4-year old child in whom no signs of salivary gland enlargement were observed. Again the complement fixation test revealed a fourfold increase in antibody.

The course of lymphochoriomeningitis in a man, 25 years old, as shown in Fig. 4 may be compared with that of this child. It is clear that from the clinical picture the two cases could not have been distinguished with certainty. But the man with lymphochoriomeningitis, from whose spinal fluid the virus was isolated, gave a negative complement fixation test for mumps.

It should be pointed out that this test method can also be employed in the determination of resistance. This application is based on certain considerations: it has been shown that a low concentration of antibody may persist indefinitely in many individuals following an attack of the disease which nearly always confers permanent resistance.[9, 10, 13] Thus a positive test, whenever obtained, may be accepted as evidence of previous infection and hence of im-

*We are indebted to Dr. Charles A. Janeway for the figures and the clinical notes on these two cases of mumps meningoencephalitis and the case of lymphocytic choriomeningitis subsequently mentioned.

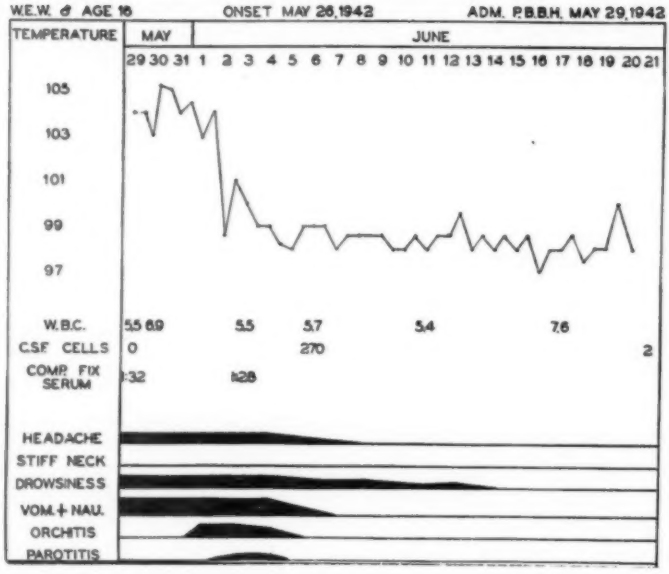


Fig. 2.—Mumps meningoencephalitis with orchitis and slight parotitis.

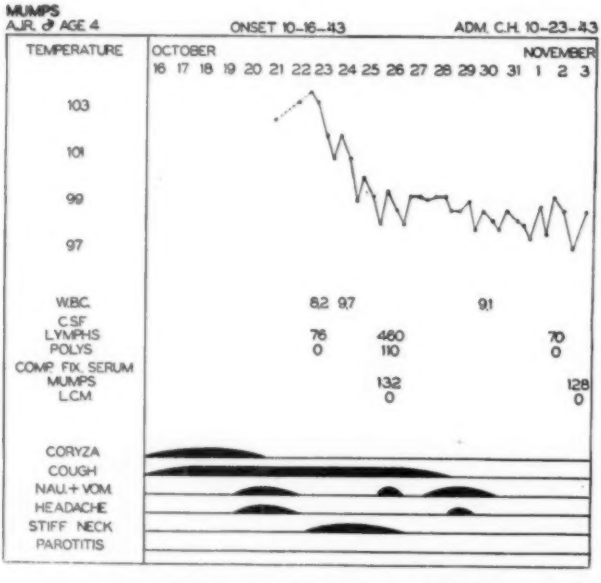


Fig. 3.—Mumps meningoencephalitis without other manifestations of infection.

munity. That such infection may not always be characterized by parotitis or some other overt manifestation but may be subclinical has also been demonstrated. The experimental data supporting this latter statement are not presented here, but they leave no doubt that inapparent infections—long suspected on epidemiologic grounds—are frequent.

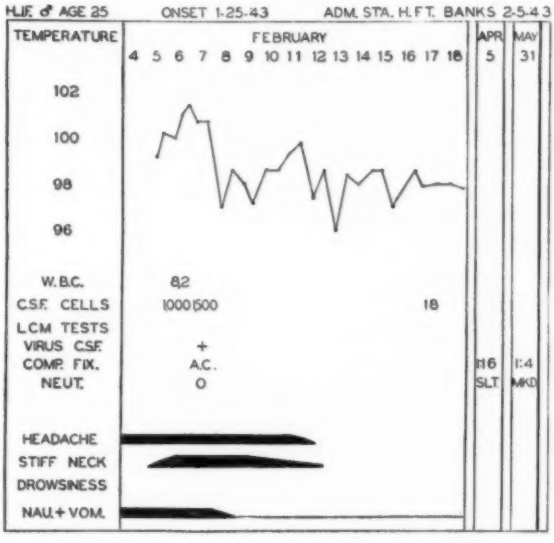


**Fig. 4.—Lymphocytic choriomeningitis.**

The occurrence of subclinical attacks as well as the well recognized unreliability of a history of mumps as given by the average person make clear the need of some sort of a test for susceptibility and resistance—a need which would immediately become a necessity should effective procedures for vaccination or serum prophylaxis be devised. But in this role the complement fixation test presents certain disadvantages because of the complexity of the technique and the fact that, in a not inconsiderable proportion of persons, following infection the antibody falls below the detectable level. Therefore another method was sought. It has been known for many years that the immediate reaction following vaccination against smallpox in immune individuals is an allergic response which may even be produced with heat-inactivated virus. It seemed possible that the individual immune to mumps might show a similar behavior. We therefore inoculated by the intradermal route a few persons who were able to give unequivocal histories of mumps with 0.1 c.c. of a dilute saline suspension of infected monkey parotid inactivated by heating at 65° C. for 20 minutes. Local inflammatory reactions characterized by erythema and slight induration ranging from somewhat over 10 to 30 or 40 mm. in diameter were observed after 24 and 48 hours. Such reactions did not ensue following

the inoculation of normal monkey protein nor were they observed in about one-half the people without history of mumps who were likewise tested at that time. Moreover it was shown that persons who failed to respond before or immediately after the onset reacted strongly following convalescence.[7] These preliminary observations, which in general have been substantiated by a large number of subsequent studies,[14] indicated that the person previously infected, whether overtly or subclinically, becomes, in nearly all instances, hypersensitive to the virus. This hypersensitivity apparently may persist for many years and is often present in those whose complement fixing antibody can no longer be demonstrated.

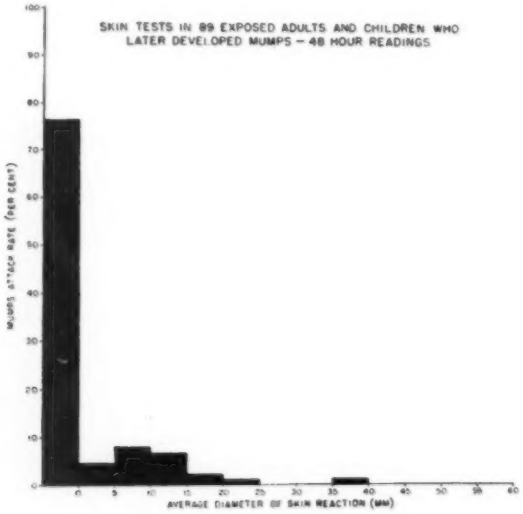
SKIN TESTS IN 89 EXPOSED ADULTS AND CHILDREN WHO LATER DEVELOPED MUMPS – 48 HOUR READINGS
MUMPS ATTACK RATE (PER CENT)
AVERAGE DIAMETER OF SKIN REACTION (MM)

Fig. 5.

The procedure of skin testing thus seemed to offer a simple and convenient method of determining susceptibility or resistance; and so, in collaboration with Stokes and Maris, a considerable amount of effort has been expended to obtain a satisfactory quantitative estimate of its accuracy and to establish more securely its significance in relation to the immunologic status of the individual. With these objectives in mind, a number of groups of children and adults were tested shortly before or soon after they were exposed to mumps. Most of them were living in dormitories of schools and institutions where the intimacy of contact tended to insure intense exposure. A total of 89 cases of mumps developed among these groups after skin tests had been carried out. As shown in Fig. 5, nearly 80 per cent of these cases occurred in those who gave no reaction whatsoever. The others appeared in individuals who responded in some degree to the inactivated virus. Over one-half of these reactions, however, were less than 11 mm. in diameter. Thus more than 90 per cent of the cases developed in persons who failed to react at all or whose reactions were

minimal. A few cases appeared in those whose reactions were larger, but in most instances not exceeding 11 to 15 mm. in diameter. Taking reactions less than 11 mm. in diameter as negative, i.e., as signifying presumptive susceptibility, it would seem possible by means of the skin test to distinguish the susceptible from the nonsusceptible individual within an error of 10 per cent or less.

The relations between skin-reaction size and susceptibility or resistance are given additional emphasis in Fig. 6 where the attack rates of mumps are plotted against the distribution of reaction-sizes. It will be seen that about one-third of the negative reactors developed mumps following exposure. Those with reactions less than 11 mm. showed about one-half this attack rate. In contrast the attack rate for those with reactions ranging from 11 to 15 mm. was only about 7 per cent, and it was still less among the group with reactions greater than 15 mm. It may be concluded, then, that the skin test affords a reasonably accurate index of immunity or susceptibility. It is clear, however, that as with all such procedures, there is inherent in the method a certain degree of error which diminishes rapidly as the reaction-size increases.

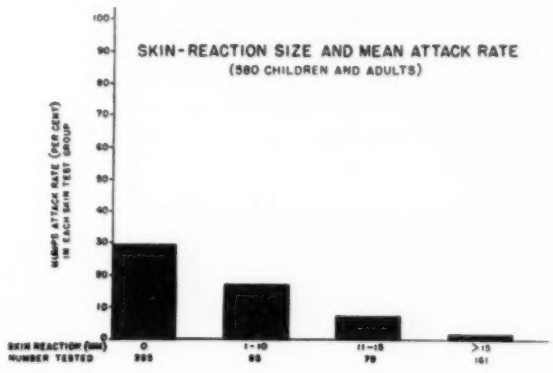


Fig. 6.

Additional interesting evidence for the correlation of resistance with a positive skin test is revealed by a comparison of the attack rates with the incidence of positive tests in various closed communities and in families where small epidemics have been studied. From Fig. 7 it will be seen that when the proportion of positive tests in a group was 50 per cent or less, the attack rate in all but one epidemic ranged from 40 per cent to about 10 per cent. On the other hand, when the incidence of positive tests exceeded 50 per cent, the attack rates were all under 5 per cent. This inverse relationship between attack rate and positive test might have been predicted from generally recognized epidemiologic principles if the test were indeed an index of immunity. Should further trials confirm these data, it is evident that the test could be employed in exposed groups as a means of obtaining a rough idea as to whether a large or small number of cases might subsequently be expected to develop.

The skin test studies just described have all been done with preparations of infected monkey gland. A limited number of observations, both Habel's[5] and our own,[14] have shown that materials from the infected egg can also be employed as a skin test agent.

Certain investigations which have been carried out during the last three years to determine the prophylactic value of materials of human origin containing mumps antibody. As early as 1942, it was demonstrated[15] in our laboratory that in the gamma globulin prepared by Cohn and his associates from large pools of normal plasma the mumps complement fixing antibody was concentrated from 15 to 25 times. With this fact in mind, Stokes and Maris administered 8 c.c. of globulin to each of 25 institutionalized children who were members of a group of 66 which had been exposed to mumps and whose com-

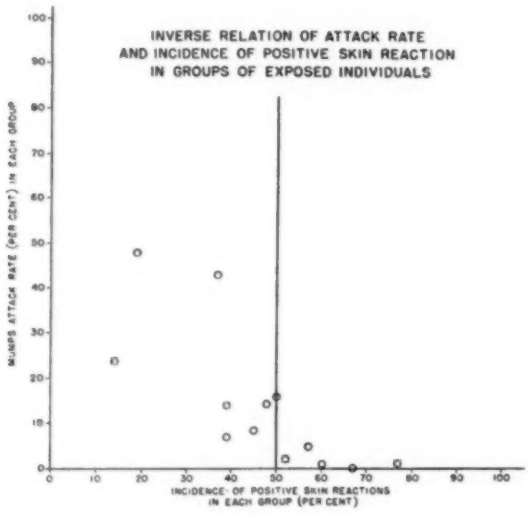


Fig. 7.

plement fixation tests were at this time negative. From the sixth to the sixteenth day after the globulin was given, 10 cases of the disease appeared among those who had received it and 16 cases among the 41 individuals who were not injected.[16] This clear-cut negative result shows that the normal human gamma globulin, which has proved effective in the prevention of measles, is of no value in the prophylaxis of mumps. From observations made on 154 patients with early mumps, of whom 67 received the globulin, Gellis, McGuinness, and Peters[17] concluded that this material did not prevent the development of orchitis even when administered in doses as large as 50 c.c. and before any signs of testicular involvement were present. Calculated on the basis of the antibody concentration, this dose of globulin would be equivalent to about 1,250 c.c. of normal human plasma.

TABLE III. ORCHITIS IN MUMPS PATIENTS INOCULATED WITH GAMMA GLOBULIN CONCENTRATE OF MUMPS CONVALESCENT SERUM*

| GROUP | NO. | CASES OF ORCHITIS | |
|---|---|---|---|
| | | NO. | % |
| Inoculated with globulin | 51 | 4 | 7.8 |
| Uninoculated | 51 | 14 | 27.4 |

*After Gellis, McGuinness, and Peters.[17]

On the other hand, these same authors obtained results which indicated a prophylactic effect following the administration of 20 c.c. of a gamma globulin concentrate prepared from a large pool of convalescent mumps sera. A summary of their findings is given in Table III. There was in this material 20 times as much complement fixing antibody as in the convalescent plasma and 10 times as much as in the normal gamma globulin. The dose injected, therefore, was equivalent to 400 c.c. of convalescent serum or 200 c.c. of normal gamma globulin. Obviously this represents a much larger quantity of convalescent serum than has been used hitherto in attempts to protect passively against mumps or mumps orchitis. In the form of serum, even if such amounts were readily available, it would be impracticable to administer.

In the light of these observations, it may be concluded that either the protective factor in the blood of those previously infected is relatively ineffective in neutralizing the virus as compared, for example, with the prophylactic agent in measles, or that it is normally present only in very low concentration. Therefore, the conflicting statements and equivocal results to be found in the earlier literature on the prophylactic value of mumps convalescent serum can be now understood.

A certain amount of direct evidence which indicates that the neutralizing factor as distinct from the complement fixing antibody is indeed present only in small quantities has lately been secured by means of titrations carried out in chick embryos.[18] Decreasing amounts of convalescent serum or normal gamma globulin were mixed with 1 to 25 minimal infecting doses of virus and then inoculated into eggs. It was found that the undiluted antibody solutions completely prevented infection of the embryo but when they were diluted more than 8 times, they exerted no protective effect.

At the moment, then, we may assert that a practical method of serum prophylaxis is not available. Furthermore, unless some means of greatly increasing the neutralizing factor is discovered, there would seem to be little likelihood that in the future passive immunization in mumps will prove to be successful.

Certain experiments have had as their objective the development of a practical method of inducing active immunity.[10, 11, 19] Comparatively recent studies on the immunizing properties of a number of viruses after inactivation by formalin or other agents have proved, contrary to the older view, that such material was capable of inducing an effective resistance against experimental and natural infection. As examples, we may mention the formolized egg-vaccine which has been employed in horses and in man as a prophylactic against

equine encephalomyelitis. Similarly the formol-inactivated influenza virus which is now being used in the Army apparently is capable of protecting a majority of those who have received it. Thus, when it was determined that the infected parotid gland contained large amounts of virus-antigen, we at once proceeded to ascertain whether a suspension of this tissue, treated with small amounts of formalin, would immunize monkeys.[3] Two doses of 0.5 c.c. each were administered subcutaneously at an interval of five days and a challenge inoculation of active virus was introduced into the parotid gland on the seventh to the ninth day following the second injection of vaccine. The results showed that approximately two-thirds of 16 vaccinated animals exhibited signs of increased resistance. A further indication of the antigenicity of the vaccine was afforded by the fact that complement fixing antibody developed in about one-half of these vaccinated animals.

On the basis of these findings, Stokes and Maris, with our collaboration, have carried out four experiments in groups of institutionalized children with the consent of their parents or guardians. Presumptively susceptible individuals were selected by means of the complement fixation test in all cases and by means of the skin test in two of the experiments. The skin test was not uniformly applied because of the possibility that this procedure itself might in some instances give rise to increased resistance. Two 1 c.c. doses of formolized virus were given subcutaneously in all the vaccinated groups with a single exception in which three doses were administered. In the first two experiments the immunity was challenged by inoculation of active monkey virus introduced directly into one parotid gland via Stensen's duct. In the last two experiments the active virus was sprayed into the oral cavity. In each experiment were included groups of controls who did not receive the vaccine but were inoculated with active virus.

TABLE IV. VACCINATION OF HUMAN BEINGS WITH FORMOL-INACTIVATED MUMPS VIRUS

| EXP. | ROUTE CHALLENGED | VACCINATED | | CONTROLS | |
|---|---|---|---|---|---|
| | | RESISTANT | SUSCEPTIBLE | RESISTANT | SUSCEPTIBLE |
| I | Stensen's duct | 5 | 1 | 0 | 6 |
| II | Stensen's duct | 6 | 2 | 3 | 4 |
| III | Oral cavity | 11 | 6 | 1 | 8 |
| IV | Oral cavity | 9 | 1 | 4 | 6 |
| | Total | 31 | 10 | 8 | 24 |

| | |
|---|---|
| Vaccinated groups: resistant | 76% |
| Control groups: resistant | 25% |
| Difference | 51% |
| Difference / Standard error of the difference | 4.3 |

The results obtained in these four experiments are summarized in Table IV. It will be seen that about three-fourths of the vaccinated children presented evidence of increased resistance as contrasted with about one-fourth of those in the control groups. This difference of about 50 per cent is statistically significant. It will also be noted that the degree of protection which may be attributed to vaccination is of the same order of magnitude as that recorded in the monkey-vaccination experiments. These results are definitely encouraging

but the incidence of protection is not as great as might be wished. Moreover, it is probable that the immunity would be of short duration like that induced by other inactivated viruses such as influenza.

At this point it should also be made clear that the formolized vaccine appears to have no prophylactic effect when given during the incubation period of the natural disease. A study carried out by Stokes and Maris in family groups has not revealed any significant difference in the incidence of mumps among 50 skin test-negative individuals of whom 27 were given the vaccine after exposure.[19] There was an indication, however, that this procedure might have reduced appreciably other more serious manifestations such as orchitis or encephalitis.

As yet trials in human beings with formolized virus obtained from the egg have not been made, although one experiment in monkeys has demonstrated the prophylactic properties of such material. Unlimited quantities of the virus grown in this medium could now be obtained, if required, for the production of vaccine. The egg virus could also be concentrated by means of adsorption and elution from the red blood cells of the chicken in a manner entirely analogous with that now employed by Francis in concentrating the influenza virus for use as a vaccine; since, as we have recently shown,[6] the mumps virus becomes adsorbed on red cells, causes their agglutination, and is again spontaneously released in the same manner as that of the influenza virus.

Cultivation of mumps virus in the egg has, however, suggested another and perhaps more promising line of attack on the problem of active immunization. One might expect that, following continued passage in this host, the pathogenic properties of the virus would be reduced for the monkey and for man. As far as the monkey goes, experiment has already verified this expectation.[20] After 15 egg passages, the virus inoculated into the parotid glands of two monkeys failed to produce swelling in one and produced only moderate swelling in the other. After 25 egg passages the virus caused no swelling in four monkeys which received this material. In both experiments the animals, however, were found to be immune on subsequent challenge with active monkey virus. Studies are now in progress to determine whether this living, attenuated, egg-passage virus will produce immunity in man without giving rise to the typical disease. Some evidence that the pathogenic properties for the human being have been markedly reduced is available, but as yet it has not been determined whether resistance is increased following oral inoculation of such egg-passage material. The establishment of an effective procedure of this sort would, however, seem to be a definite possibility and, should it become available, one might anticipate from the effect of the attenuated vaccines employed against smallpox and yellow fever that the immunity so induced would be highly efficient and permanent.*

*The investigations leading to the results which have been reviewed in this paper were carried out as a project of the Commission on Measles and Mumps, Board for the Investigation and Control of Influenza and Other Epidemic Diseases in the Army, Preventive Medicine Service, Office of the Surgeon General, United States Army.

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# JUVENILE RHEUMATOID ARTHRITIS

## A Study of Fifty-Six Cases With a Note on Skeletal Changes

James A. Coss, Jr., M.D., and Ralph H. Boots, M.D.
New York, N. Y.

SINCE the organization of an arthritis clinic at Columbia Presbyterian Medical Center in 1928, we have had the opportunity to observe fifty-six cases of rheumatoid arthritis in children. This group includes those cases in which the onset was at 12 years of age or earlier, and represents 4.9 per cent of all cases of rheumatoid arthritis seen in this clinic. While we do not accept a separation of juvenile from adult rheumatoid arthritis, some such arbitrary division was necessary for this discussion.

We have not used the term Still's disease as there seems to be no justification for this special grouping. Most physicians, today, consider such cases as rheumatoid arthritis, modified clinically by the age of the patient. A similar situation arose in the use of the term Felty's syndrome[1] for cases of adult rheumatoid arthritis associated with leucopenia and enlargement of the spleen and liver. It is now generally recognized that these associated findings are a part of rheumatoid arthritis and not a reason for a separate classification. The term Still's disease came into common usage after 1897, when Still[2] separated juvenile rheumatoid arthritis into two groups, (1) those cases of chronic progressive polyarthritis indistinguishable from that seen in adults, and (2) a group with similar pathologic changes in joints but associated with enlarged spleen and lymph glands, and sometimes adhesive pericarditis. The latter was thought to be a new entity. At the time, Still[2] was not aware that such lymphadenopathy and splenomegaly occur, although less frequently, in adults with rheumatoid arthritis. In this country, the classification was further complicated by a misuse of the term Still's disease as synonymous with rheumatoid arthritis in children, rather than applying it only to those cases associated with splenic and lymph gland enlargement. Also there has been a confusing problem in patients followed for a period of years where the diagnosis of Still's disease was made in childhood. As they became young adults relapses of the disease occurred, and then these patients were considered to have rheumatoid arthritis. For these reasons, we agree with those who have discarded the term Still's disease. One of the most recent classifications of arthritis, that of the New York Rheumatism Association, includes such cases under *Rheumatoid Arthritis, juvenile type.*

In certain cases in this series which were followed for several years the diagnosis was at first uncertain. This was particularly true when it was necessary to differentiate between rheumatoid arthritis and rheumatic fever. A therapeutic trial with salicylate was helpful in some of these cases. The problem was further

From the Edward Daniels Faulkner Arthritis Clinic of the Presbyterian Hospital and the Department of Medicine, Columbia University, College of Physicians and Surgeons.

Many of the patients were originally seen in Babies Hospital. We wish to thank Dr. Rustin McIntosh and his staff for permission to report them.

complicated by the fact that seven patients had electrocardiographic changes distinct enough to be labeled myocardial damage or carditis. In such instances as these, time has been our most valuable diagnostic ally. Six patients showed a return of the electrocardiographic pattern to normal on subsequent examinations. A follow-up record was not available in the seventh. Rheumatoid arthritis is a systemic disease even though by definition we emphasize the condition of the joints, and we have learned to expect a variety of systemic lesions, from the adhesive pericarditis described by Still to many other lesions reported in recent years.[3, 4]

Even though the diagnosis be doubtful early in the disease, if periarticular swellings, contractures, loss of motion, joint effusions, characteristic x-ray changes, muscle atrophy, subcutaneous nodules, enlarged lymphatic glands, splenomegaly or hepatomegaly appear, and if these changes, including various types of joint involvement, persist over a period of years, we must say they are cases of rheumatoid arthritis, regardless of associated systemic changes.

One of us (R. H. B.) has described[5] three types of cases where the differential diagnosis between rheumatic fever and rheumatoid arthritis is difficult, viz.:

1. Chronic adult rheumatic fever
2. Rheumatoid arthritis following previous bouts of rheumatic fever
3. Acute onset of rheumatoid arthritis, with subsequent chronic progressive arthritis. Nearly all of the diagnostic problems in this study were in the last category.

In addition to objective clinical studies, x-ray and laboratory tests were done in most cases, including urinalysis, blood count, erythrocyte sedimentation rate, tuberculin skin test, Kline reaction, antistreptolysin-0 determination, and agglutination of Group A hemolytic streptococci. Throat cultures and electrocardiograms were obtained when indicated.

*Age and Sex.*—Chart I illustrates the age and sex incidence of juvenile rheumatoid arthritis in our series. The earliest age of onset was 14 months. Still[2] found the ratio of females to males to be only 1.5 to 1. In our series, the ratio was 5 females to 1 male, or approximately the same as in adult rheumatoid arthritics. This finding corresponds with that of the series reported by Colver.[6]

*Family History.*—In 18 instances (32 per cent) a history of possibly related conditions was obtained. These included rheumatic fever, 6; chorea, 1; rheumatoid arthritis, 4; recurrent arthralgia, 2; allergic symptoms (asthma, angioneurotic edema), 3; respiratory diseases, including frequent colds, 4; and "heart disease," 2. In some instances a background of two or more related illnesses was given. This incidence of related illness is much higher than would be found in a similar series of normal individuals.

*History of Preceding or Associated Illness.*—Thirty-two cases, or 57 per cent, had a history of respiratory tract infection including pneumonia, bronchitis, recurrent sore throats, sinusitis, or otitis preceding or associated with the onset of arthritis. Seven cases, or 12.5 per cent, had a preceding or concurrent

history of gastrointestinal disturbance such as poor weight gain, anorexia, diarrhea, or constipation. Thirty-nine cases (69 per cent) had a history of frequent ear, nose, and throat infections at some time in the course of the illness. This seems to bear out the observation of many physicians that the incidence of associated respiratory infections is much higher in these patients than in the general population. Other than the gastrointestinal disturbances mentioned, it is our impression that an unusually large proportion of these patients are characterized by their parents as "colicky," "finicky eaters," nervous, or easily upset. Only one patient in this series had previously had rheumatic fever.

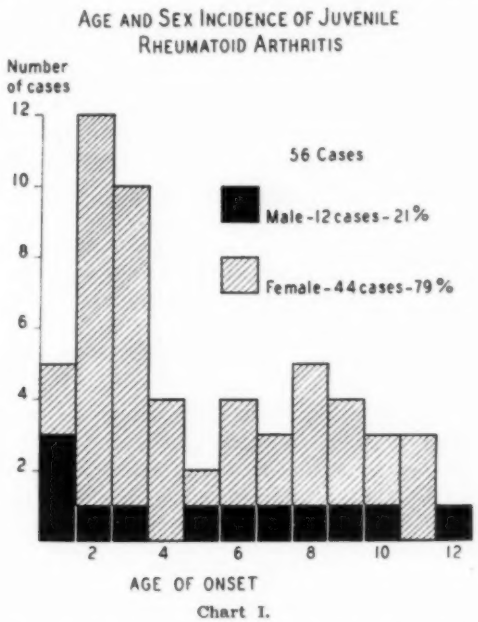


Chart I.

*Physical Findings.*—We have determined the incidence of some of the secondary characteristics commonly associated with juvenile rheumatoid arthritis. There were 13 cases (23 per cent) of hepatomegaly, 17 cases (30 per cent) of splenomegaly, and generalized glandular enlargement of varying degree was noted in 35 cases, or 60 per cent.

In many studies of this form of arthritis, one finds descriptions of flexion deformities of the extremities. This has occurred in our experience usually as a result of improper treatment, particularly the neglect of simple but important measures such as splints and physiotherapy, together with adequate rest.[7] Some patients develop deformities regardless of care given, a number of these can be returned to full physical activity through the intervention of orthopedic surgery when the acute stage has passed.

The reported lack of pain in Still's disease was not characteristic of this series. Practically every patient at some time in the disease has complained

of pain. It has also been stated that the terminal interphalangeal joints are frequently involved in Still's disease as contrasted to the proximal joint involvement in adults. This was seen in some cases but was not of unusual incidence. Subcutaneous nodules were seen in two cases. They were similar in size and distribution to those seen in adult patients with rheumatoid arthritis.

When information was complete enough to draw conclusions, we evaluated the cardiac status. Thirty-one cases (53 per cent) showed no abnormality on physical examination or electrocardiogram; the remaining 47 per cent had some cardiac disturbance. There was a tachycardia in 13 instances, a systolic murmur of varying intensity (never harsh) in 13 cases, and in 7 cases the electrocardiographic variation was great enough to be diagnosed as "evidence of myocardial damage" or "carditis." Six of these reverted to normal in later examinations. A patient whose condition was previously diagnosed rheumatic fever, rather than rheumatoid arthritis, on the basis of electrocardiographic reports, now has an obvious rheumatoid arthritis with typical joint deformities and negative heart on electrocardiographic and physical examination. Still[2] was impressed by the high incidence of adhesive pericarditis in this condition (3 definite and 5 possible instances in a series of 12 cases). It was possible to demonstrate this in one of the two fatal cases in the present series.

*Laboratory Data.*—There was a tendency to moderate anemia in about 80 per cent of the cases, the remainder had essentially normal hemoglobin and red blood cell values. Leucocyte counts showed the most striking deviations from normal. In 37 per cent of the patients, on the basis of the highest count recorded, the leucocyte count was above 15,000, and in 17 per cent of the patients it was above 25,000. In Table I leucocyte counts are compared with prognosis. While correlation is not exact, it is interesting to note that most of the patients showing marked improvement never developed a high degree of leucocytosis, whereas the fatal cases had leucocytosis reaching 30,900 and 36,000, respectively.

TABLE I. CORRELATION OF PROGNOSIS AND LEUCOCYTOSIS (48 CASES)

| DEGREE OF IMPROVEMENT | LEUCOCYTE COUNT (IN THOUSANDS) | | | |
|---|---|---|---|---|
| | BELOW 15 | 15 TO 20 | 20 TO 25 | 25 OR OVER |
| Marked | 14 | 1 | 1 | 3 |
| Moderate | 8 | 5 | 0 | 0 |
| Slight | 2 | 0 | 0 | 2 |
| None | 6 | 2 | 0 | 4 (2 deaths) |
| Total Patients | 30 | 8 | 1 | 9 |

Eosinophile leucocyte counts were done in many cases, particularly if the patients were receiving chrysotherapy. Eosinophilia has been considered in this clinic to be a fairly reliable indicator of early gold toxicity as it was found to precede onset of a rash in adults. Six patients treated with gold exhibited an eosinophile count of 5 per cent or more. Four patients developed this degree of eosinophilia without gold therapy. In two instances the degree of eosinophilia while on chrysotherapy reached particularly high levels. Neither of these patients developed a rash or other toxic symptoms although the eosinophilia fell rapidly when treatment was interrupted. We concluded that eosinophilia may

be an indication of early gold toxicity but its relation to the onset of rash in children is only fortuitous.

Albuminuria of high degree was noted in the patient who developed amyloidosis but in no other instance was it a constant or troublesome feature. One case of persistent albuminuria was hypostatic in nature.

The erythrocyte sedimentation rate was determined by the Westergren[8] method. In most cases, clinical improvement is correlated with the erythrocyte sedimentation rate; however, this is by no means absolute. Many patients with a fairly high erythrocyte sedimentation rate showed moderate or marked improvement, and several patients with a normal erythrocyte sedimentation rate had continued rheumatoid activity. The fall of the sedimentation rate on treatment is not an absolute indication of improvement. The blood Wassermann was negative in all cases tested. Tuberculin skin tests were negative in all but one case. X-ray studies are reviewed in the last part of this paper.

*Bacteriology.*—Of 28 patients tested one or more times, 17 were found to harbor hemolytic streptococci in their throats. Group and type were not recorded but the high incidence of hemolytic organisms seems significant in itself. Bourn and associates,[9] in a study of 1,460 subjects, found throat cultures positive for hemolytic streptococci in 19.8 per cent of children under 9 years of age, in 9.3 per cent of all ages without respiratory infection, and in 11.8 per cent of all ages with respiratory infection.

The antistreptolysin titer[10] was determined one or more times in 24 cases. The median figure obtained, 250, is significantly higher than the upper limits of normal. Other workers have considered any titer above 100 as suggestive of previous hemolytic streptococcus infection.[11, 12]

Streptococcus agglutination tests[13] were done in 35 patients and in only 3 of these was there a positive reaction. One was an adult when the positive reaction was obtained. The experiments of Freund[14] and various others[15] on the relationship of age to immune mechanisms suggested that many of the negative reactions would become positive with increasing age. However, in repeated tests of 17 patients over periods as long as 14 years, no increase in the agglutinating activity of the serum was observed.

*Prognosis.*—Colver[6] has stated that in a series of 37 cases, the duration of disease was never over seven years and he felt that one could predict the cessation of activity within a maximum period. We realize that this is a very difficult thing to evaluate accurately but our experience has not led us to such optimism. One patient in particular, in our series, has had six well-defined periods of activity in a 23-year interval. Twenty-one of 50 cases have had a duration of 5 years or more, and twelve cases have had a duration of 7 years or more. This is in contrast to Colver's series in which there were no cases exceeding seven years' duration.

Removal of foci of infection has had a beneficial effect in isolated cases. In other cases, just as striking results were noticed of an opposite nature with an increase in activity following removal of foci.

Relation of mortality to duration of illness cannot be determined in our series as there have been only two deaths. One of these patients died within a few months of the onset of the disease, the second had had the disease fourteen years. These two fatalities will be reviewed.

Fig. 1.—D. D. (right) at the age of 6 years, 9 months, and before the onset of arthritis. Her sister (left), 1 year, 10 months younger.

*Gold Therapy.*—The results of treatment with gold and with other forms of therapy were studied. Thirty-four patients received supportive measures such as rest, transfusion, splints, physiotherapy, and salicylates. Focal infections were treated and in a few cases vaccines were given. Twenty-two patients received gold as well as the other various measures of treatment. The average course consisted of 600 mg. gold compound,* but a few patients received 1,000 to 1,200 mg. Others received as little as 95 mg. depending on the clinical picture or signs of toxicity. Because of the small number of cases treated and the extreme variation in total gold dosage, it has been impossible to evaluate comparatively the response to treatment in these two groups.

*Solganal B Oleosum used in this study was supplied through the courtesy of Schering Corporation, Bloomfield, N. J.

The frequency and severity of toxic reactions produced by gold have been recognized since the introduction of chrysotherapy. Of 22 patients receiving chrysotherapy, 10 had a reaction of mild degree and there were 2 fairly severe reactions. The mild cases included: transient rash, 7 cases; pharyngitis, 2 cases; transient marked eosinophilia (without rash), 2 cases; and transient thrombopenia, 1 case. One patient developed an hepatitis after receiving 95 mg. of gold salt. This case is being reported in detail elsewhere.[16] There was

Fig. 2.—D. D. (right) at the age of 12 years, 7 months, five years and three months after the onset of rheumatoid arthritis. Note undershot jaw and generalized lack of development as compared with normal younger sister (left).

momentary improvement in the arthritis which reverted to its previous level when the jaundice cleared. A second patient developed a rash with nausea and vomiting which subsided with no sequelae after gold was omitted. Of the 7 cases of mild rash we are not at all certain that some of these were not a result of the disease process rather than chrysotherapy, for we occasionally see erythema or vesicle formation in the course of the illness when no specific treat-

ment of any kind is being given. The natural history of Still's disease is often so bizarre that it is easy to blame a medication for some of its manifestations.

*Skeletal Changes.*—Taylor and others[17] have suggested a method of comparing various forms of arthritis roentgenographically. From this work we have used four criteria which seem to be most characteristic of juvenile rheumatoid arthritis: viz., decalcification, bone destruction, joint space narrowing, and soft tissue changes.

Fig. 3.—C. B. X-ray of cervical spine prior to onset of arthritis. (Age, 1 year, 4 months.)

X-ray studies were available in 47 cases and in all cases studied at least one of the selected criteria was present. In 20 cases, two items were present; in 9 cases, three; and in 7 cases, all four changes were demonstrable. As would be expected, more marked changes were seen in the older patients who had had the disease for a longer time. Joint changes as evidenced roentogenographically are often rather late to appear, just as in adult rheumatoid arthritis.

Taylor and associates concluded that the roentgenologic picture of juvenile rheumatoid arthritis was identical with that of rheumatoid arthritis in adults. For the most part this is true, but in studying a larger series of cases we have noticed additional features peculiar to arthritis in the young age group. Many observers have remarked about the generalized failure of maturity and the bird-like facies in juvenile arthritis since it was first described by Still (Figs. 1 and 2).

Fig. 4.—C. B. X-ray of cervical spine after arthritis had become obvious in fingers and toes. Note fusion of $C_2$, $C_4$, and $C_5$. Patient complained of pain and loss of motion in the neck.

*Cervical Fusion:* Reviewing the x-rays in our series, we discovered instances where a fusion of cervical vertebrae had occurred following arthritis. This change in children has usually been spoken of as congenital failure of segmentation. We feel that this is not a failure of segmentation but a bony fusion resulting directly from arthritis in the involved area. Figs. 3 and 4

show the cervical spine of a child just at the onset of arthritis and twelve years later when the process had become quiescent but pain in the neck persisted.

*Brachydactylia:* Other cases have also exhibited an interesting phenomenon, shortening of fingers or toes which had previously been the site of early involve-

Fig. 5.—R. T. Showing shortening of left middle and right middle and ring fingers. Arthritis severe.

Fig. 6.—C. R. Showing shortening of fingers. Definite rheumatoid arthritis, juvenile type.

ment with arthritis. Some of these patients have early photographs showing the normal fingers before the onset of disease. (Figs. 5 and 6.) Similar changes have been described in conditions other than arthritis, such as poliomyelitis.[18] In 56 cases of arthritis, 22 (39 per cent) were discovered to have disturbed

skeletal patterns of varying degree. Fourteen patients (25 per cent had definite brachygnathia, 7 cases (13 per cent) had changes in the cervical spine; one of these was a forward luxation of one vertebra on another; the remaining 6 cases exhibited fusion of two or more cervical segments. Six patients (11 per cent) had shortened fingers or toes (brachydactylia). Fourteen of the cases were aged 3 years or less at onset of their arthritis.

Fig. 7.—C. R. X-ray of hands in Fig. 6.

## DISCUSSION

The natural history of juvenile rheumatoid arthritis has been discussed on the basis of a study of 56 cases. This is 4.9 per cent of all cases of rheumatoid arthritis seen in this clinic. Still's disease suggests a distinction between conditions the differences in which are not related to the nature of the disease process but to the reaction of the body against that process as it varies in different age groups. Age and sex incidence of arthritis in this juvenile group is about the same as has been reported in other series. Family history and personal history of the patient bear more than an incidental relationship to this condition. The presence of splenomegaly, hepatomegaly, or generalized glandular enlargement is not a necessary part of the diagnosis of juvenile rheumatoid arthritis although it is more frequent than in adult arthritis.

Cardiac changes were seen in some of our patients and, if the arthritis had disappeared early with no residuum, one would be inclined to classify them as rheumatic fever. With persistent arthritic manifestations, however, cardiac involvement seems to indicate the close relationship between the two conditions.

We are no nearer to an elucidation of the etiology of this condition than before, but the high incidence in this series of elevated antistreptolysin titers and throat cultures positive for hemolytic streptococci makes us hesitate to

discard the bacteriologic approach. The many similarities between rheumatic fever and rheumatoid arthritis lead to the interesting conjecture that we may be dealing with the same type of process as has been suggested in the former condition, viz., recurrent hemolytic streptococcal infection and its consequences. In the case of rheumatoid arthritis, one postulates a lag period of months instead of weeks between infection and clinical symptoms, plus a far more insidious onset, as a rule, and an equally insidious remission. These factors make it impossible, using present methods, to incriminate the streptococcus except by inference.

A review of the laboratory data shows an interesting correlation of leucocytosis and prognosis. In 8 patients with leucocytosis over 25,000, only 4 improved, and 2 of the unimproved died. In two cases where eosinophilia became extreme during gold therapy, no rash developed, and in other instances a rash developed without preceding eosinophilia.

A fall in erythrocyte sedimentation rate was correlated roughly with clinical improvement. There were enough exceptions to make minor variations in erythrocyte sedimentation rate alone unacceptable as an index either of activity or of improvement following treatment.

With chrysotherapy we have seen no irreversible toxic results in children and the only fatalities reported in this series were in the nongold-treated group. In our experience, gold therapy is no more dangerous in children than adults. Typical cases in the two groups are reported, including the two fatalities. One of these cases exhibited terminal amyloidosis.

A description of unusual skeletal changes resulting directly from early rheumatoid arthritis is given. These changes usually occur when the disease begins before the second dentition and in the first three years of life.

### CASE ABSTRACTS

CASE 12.—A girl, aged 3 years, complained of swollen right ankle and left thumb for two and one-half months. There was no previous trauma or known infection. At examination, the temperature was 100° F., pulse 140, and the tonsils were enlarged. Patient walked with a decided limp. Laboratory data: Erythrocyte sedimentation rate 32 mm. in one hour; all other values were normal. The patient was discharged in four weeks improved; then arthritis recurred and moved to the left knee. A course of gold salt was given and the tonsils were removed. As a result, her condition was much improved. One year later joint pain and swelling returned. On examination, one observer noted that the patient was developing a receding mandible. A second course of gold therapy was given and joint symptoms subsided.

The child is now 8 years old and is entirely well but for the residual change in the lower jaw (brachygnathia) and slight flexion deformity in three fingers.

Impression: Definite juvenile rheumatoid arthritis with good response to chrysotherapy.

CASE 20.—A 3-year-old girl was admitted with fever and generalized glandular enlargement. There was an extensive maternal family history of rheumatic fever and rheumatoid arthritis. Examination revealed a pale, acutely ill child with a discharging right ear, large tonsils, and nasal discharge. No heart murmur was heard but there was tachycardia of 135, generalized glandular enlargement, and polyarthritis. Laboratory data was not remarkable.

Treatment with salicylate and transfusion gave no response; temperature ranged from 100° to 104° F. Tonsillectomy was done in the second week, because of failure of

other measures, with immediate dramatic improvement. Temperature fell, arthritis and adenopathy subsided, and the patient was discharged on the ninth postoperative day.

She was readmitted overnight for a transfusion. In a month temperature again began to rise. Now the liver and spleen were enlarged, pulse was 160 to 180, temperature 103° to 105° F. The urine contained bile, and the stools were acholic. The patient was readmitted in extremis, with skin jaundiced, bleeding gums, and vomiting brown material. Laboratory data: Red blood cells, 3,000,000 to 3,800,000; hemoglobin, 63 to 69 per cent; platelet count, 176,000 to 184,000; white blood cells, 30,900; bleeding time, prolonged. Urine: Albumin 2 plus; red blood cells 1 to 3 per high power field. Blood sugar, 40 mg. per cent, rose to 161. Nonprotein nitrogen, 70.4. Carbon dioxide combining power, 50.4; direct Vandenberg, 4 plus; bilirubin, 4.16. Blood culture: Diphtheroids.

Patient expired on second day after admission.

Pathology report revealed acute yellow atrophy of the liver; jaundice; splenomegaly; subserous, subcutaneous, subendocardial, and myocardial hemorrhage; lobular pneumonia; fibrous pleural adhesions.

Impression: Early polyarthritis with fulminating course, improvement after tonsillectomy, followed by recrudescence, acute yellow atrophy, and death.

Medication: Salicylates; no chrysotherapy.

CASE 22.—A girl, aged 3½ years, with painful knee since bumping it against a door two months before. An x-ray was taken elsewhere and possible fracture diagnosed. After wearing a cast for one month, the child was unable to walk. Admission examination revealed a thin, acutely ill Negro girl. Teeth were in poor condition. Heart examination revealed only tachycardia. There was swelling of the right knee and ankle. Laboratory data: Red blood cells, 3,700,000; white blood cells, 13,800; erythrocyte sedimentation rate 70 mm. in one hour. X-ray: No evidence of recent fracture.

Course: Fever controlled with aspirin. Patient transferred to contagious hospital unimproved, because she developed measles on the ward. She was then discharged improved, only to have a flare-up of pain in left knee and rise in erythrocyte sedimentation rate. A full course of gold therapy was given with no response. Because of continued activity the patient was admitted to an institution for chronic care. The arthritis progressed; a tonsillectomy was done and a second course of gold given with no response.

At present the child wears splints and is on a Balkan frame to correct a lordosis. Erythrocyte sedimentation rate is 39 mm. in one hour. X-rays are typical of rheumatoid arthritis. Contractures and deformities keep her from any useful occupation at present.

Impression: Definite juvenile rheumatoid arthritis with poor response to therapy.

Medication: Chrysotherapy.

CASE 24.—A boy, aged 6 years, developed arthritis two and one-half years before, following a bout of tonsillitis and spiking fever. Physical examination revealed a poorly nourished boy with polyarthritis, including stiff neck, generalized glandular enlargement, hepatosplenomegaly, and soft systolic murmur. Laboratory data of note were leucocytosis ranging from 15,000 to 36,000 and x-rays consistent with rheumatoid arthritis. The patient was given transfusions and vaccine therapy and was slightly improved. Check-up in a year showed progression of joint changes, however. The patient was returned to the care of his local physician and vaccine was continued (total amount received not known).

Nine years later he was admitted to another hospital because of discovery of albuminuria. He died in uremia within four months at the age of 16 years. Pathology report showed chronic adhesive pericarditis, chronic fibrous pleurisy, chronic myocarditis and mitral endocarditis (rheumatic type), amyloidosis of kidneys.

Impression: Definite long-standing rheumatoid arthritis ending with amyloidosis and death. (There are reports of the association of rheumatoid arthritis and amyloidosis, and a high percentage occur in cases where the onset was before the age of 12.[4, 19] An association with vaccine therapy has been suggested but not proved.[19, 20]

CASE 39.—A boy, aged 8 years, with polyarthritis three and one-half months, following chickenpox and sore throat. An examination revealed a thin alert child, with enlarged tonsils

and polyarthritis. Heart examination: Faint apical systolic murmur. Temperature, 102° to 103° F.; erythrocyte sedimentation rate 114 in one hour. Tonsillectomy in third week with rapid and constant improvement. Discharged in seventh week.

Patient readmitted in five months with fever and cough. On examination, pulse 120; temperature 104° to 106° F.; rash over entire body; heart: negative except for tachycardia. Abdomen distended and rigid; splenomegaly. Generalized glandular enlargement. Laboratory data of note: White blood cells, 20,000 to 40,000; erythrocyte sedimentation rate, 130 mm. in one hour. After transfusions, salicylates, and physiotherapy, the patient was discharged improved. He was considered to be a rheumatoid arthritic with rheumatic carditis.

On follow-up he needed splints for his hands and complained of pain in the neck. X-ray revealed a forward luxation of $C_2$ on $C_3$.

Follow-up at age of 12 years: Tremendous appetite, is gaining too rapidly; heart is normal on physical examination. At age of 17, patient has full use of all extremities, is strong, muscular, does strenuous farm work, "is in excellent health."

Impression: Definite juvenile rheumatoid arthritis given poor prognosis because of fulminating character of illness. Later, remarkable improvement and now is entirely well.

Medication: Salicylates.

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# EPIDEMIOLOGIC STUDIES IN DENTAL CARIES

## I. The Pattern of Dental Caries in Iowa City Children

Julian D. Boyd, M.D., and Virgil D. Cheyne, D.D.S.
Iowa City, Iowa

MANY of the questions relating to the causation and prevention of tooth decay can be answered only through detailed and well-controlled studies of human subjects. Until the student of caries knows to what extent spontaneous variations occur in caries incidence and rates of progression in individual subjects and in given populations, he cannot appraise properly his experimental findings.

Most of the previously reported studies relating to caries incidence have been based on single dental examinations of large numbers of mouths. In some instances the data represent the composite observations of different examiners, with reasonable inference that techniques of examination and of recording were not constant. Estimates as to rates and regularity of caries progression have been based on interpolations from such cross-sectional studies, rather than from observed rates of increment. Many of the reported studies have dealt with subjects of limited geographical areas. One should not accept such studies as representative of the child population as a whole, until proved that the basic caries pattern is similar in all significant details in the contrasted localities. Contemporary studies relating to caries incidence serve better as a means of estimating tooth morbidity and mortality within a community than as a standard of prediction for findings in any individual subject.

Suitable standards for rates of caries progress cannot be deduced from cross-sectional or short-term studies of a given population, regardless of the thoroughness of such a study. Instead there is need for long-term dental studies of a large number of individual children, made with painstaking technique and constant recording method. Data as to the homogeneity of the subject personnel are also important. When the dental records can be supplemented with physical, medical, and socioeconomic data relating to each subject, the value of the study will be enhanced greatly. In the conduct of controlled studies of caries experience now under way or undertaken in the future, the methods employed should assure the utility of the data for individualized long-term study of the caries pattern.

In various institutions and clinics, data now on file could be reviewed and analyzed to aid in establishing the pattern of caries observable in the respective localities. In this institution we have at hand many serial dental records of individual children, made in a comprehensive manner and with a constant technique. Such records are available from two sources: the Children's Clinic of the College of Dentistry, and the Children's Dental Infirmary of the Uni-

From the Department of Pediatrics, College of Medicine, and the Department of Pedodontics, College of Dentistry, University of Iowa.

This study was financed in part through a grant from the Sugar Research Foundation.

versity Hospitals. We have reviewed such records, and wish in this report to present the pattern of dental caries seen in the subjects drawn from the Dental College Clinic clientele. The study is based on the records of 101 children who were examined serially not less than six times each, during an aggregate period which averaged more than five and one-half years for each child.

## METHOD OF STUDY AND OF ANALYSIS

The files of the Children's Clinic contain dental records for more than 6,000 children. Approximately one-tenth of these records cover not less than six dental examinations for each child, and cover periods of not less than three years of intermittent observation. The first 100 such records were employed for this study.*

The technique of dental examination and of recording has been essentially constant for the period of time the composite records cover. Preliminary to dental examination, the teeth were given thorough cleaning prophylaxis. Each tooth surface was examined minutely with fine exploring tines (SSW numbers 23 and 2); a mouth mirror was used, with good illumination. For each examination and recording from fifteen to twenty-five minutes were required. Separate records were made for each examination, without reference to earlier records until the examination had been completed. Note was made as to the presence or absence of each tooth. All clinically significant irregularities or involvements of enamel were recorded. Pits and fissures were marked noncarious unless there were good reason to believe that the adjacent dental structure had been damaged by caries. Cavities were indicated on the record as to location, extent, and activity. Extent was estimated from the area of the tooth surface involved, whereas activity was gauged by the penetrability of the underlying hard tissue by the exploring tine. Bite-wing roentgenograms were obtained routinely and were used to confirm and to supplement the clinical findings. In the current study, neither relative extent nor activity of individual lesions has been taken into account. Consideration was given instead to the number of teeth and of tooth surfaces which presented carious lesions of any type and degree. This simplified presentation is adequate for the purposes of the present review of our data.

The dental data for each separate examination were transcribed to the standard 80 column punched card designed for the mechanical sorting and tabulation of data. The values then were listed automatically from the punched cards in a variety of ways so as to permit study of the inter-relationship between caries incidence, age, sex, and other recorded factors.

The dental characteristics of the children studied have been analyzed to determine three aspects of caries advance: the incidence and extent of caries in each mouth, the observed rate of progression of decay for each subject, and the degree of regularity of advance of caries for the individual and for the group as a whole. The methodology employed for each analysis follows.

*When analysis of the chosen records was under way, it was found that 101 subjects had been included; further, the period of observation for five subjects was less than three years, ranging from twenty-nine to thirty-four months. Inasmuch as the dental patterns of these five children did not differ characteristically from the group as a whole, their records were included in the final analyses.

1. *The Incidence and Extent of Tooth Decay in Each Mouth.*—We were interested in the total caries incidence, and consequently have given as much attention to deciduous as to permanent teeth. As a measure of caries extent, we have dealt with affected tooth surfaces rather than with the number of affected teeth. For permanent teeth, affected tooth surfaces have included those which were decayed, missing through extraction, or filled. Extracted teeth were assumed to have had three decayed surfaces prior to extraction. In the absence of other evidence, missing deciduous teeth were assumed to have been shed rather than lost because of decay. The symbol DMF has been used to express the incidence of present and of past caries, implying that the affected areas were either decayed, missing, or filled. When referring to the deciduous dentition, the symbol DF is more nearly proper, inasmuch as missing deciduous teeth were not considered in calculating the caries score. In our charts where DMF is used in reference to the mixed dentition, it implies DMF for the permanent and DF for the deciduous teeth.

2. *The Rate of Progression of Caries.*—Months rather than years have been used to measure time in this study. The age of subjects at the time of each observation was expressed in months. When the original records failed throughout to supply the date of birth but instead gave the child's age in years, the child was assumed to have been midway between the age in years stated at the earliest examination and the next subsequent year of age. The rate of progression of caries has been expressed in terms of the average number of newly acquired DMF surfaces per annum. The value was obtained by dividing the total number of such newly affected surfaces by the number of months during which they made their appearance, then multiplying this dividend by twelve. The caries progression rates have been calculated not only in terms of the total duration of observation, but also in terms of certain segments of the total when the effect of the duration of observation on caries progress was under consideration.

3. *The Degree of Regularity of Advance of Caries.*—Each child's course of observation was subdivided into those periods during which new carious lesions appeared and those periods which were free from any clinical evidence of caries progression. The rate of advance during different periods for each child has been shown graphically. The data concerning nonadvance of caries are offered for each subject in terms of the individual periods as well as of aggregate periods during which no new carious lesions were detected.

## PRESENTATION OF DATA

1. *Nature of Subject Personnel.*—Table I lists the number, age, and sex of the subjects, the duration and number of dental observations, the intervals between successive examinations, and the state of dentition for the subjects at the initial and terminal observations in terms of chronological age.

2. *Summary of Dental Findings.*—The summarized values for caries experience in all of the subjects are shown in Table II, in terms of age and of sex. Six-hundred-and-three serial dental records are included in this summary. It is obvious that the same child's serial findings will appear recurrently in the several age categories. In this tabulation, records which were not separated by

TABLE 1. DESCRIPTION OF SUBJECT PERSONNEL

*Number of Subjects: 101 Children, 60 Boys and 41 Girls*

Age of subjects
Initial age range, 2 to 11 years; median age, 5 years
Terminal age range, 5 to 16 years; median 12½ for boys, 10½ for girls
Duration of observations
Individual range, 29 to 128 months
Total (aggregate), 6,839 months
Average duration, 67½ months
(90 per cent were observed longer than 48 months)
No. of observations
Individual range, 6 to 13
Total (aggregate), 772
Average, 7.6
Interval between dental examinations:
Range, 1 to 51 months
Median, 9½ months
Range for middle one-half of subjects, 3 to 9 months (75 per cent of intervals did not exceed 12 months)

*Number of Deciduous and of Permanent Teeth Present in Mouths at Initial and at Terminal Observations, Together With Number of Extractions of Permanent Teeth*

| AGE | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | Totals |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | *Boys: Initial Examination* | | | | | | | | | | |
| No. of subjects | 1 | 9 | 9 | 13 | 11 | 10 | 4 | 2 | | 1 | | | | | | 60 |
| Teeth present | | | | | | | | | | | | | | | | |
| Dec. | 20 | 177 | 180 | 253 | 172 | 178 | 55 | 28 | | 2 | | | | | | 1,062 |
| Perm. | | | | | 24 | 56 | 39 | 20 | | 23 | | | | | | 162 |
| Extracted | | | | | | | | | | | | | | | | 0 |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | *Boys: Terminal Examination* | | | | | | | | | |
| No. of subjects | | | | | | 3 | 1 | 5 | 11 | 9 | 12 | 8 | 7 | 2 | 2 | 60 |
| Teeth present | | | | | | | | | | | | | | | | |
| Dec. | | | | | | 40 | 12 | 51 | 95 | 35 | 29 | | | | | 262 |
| Perm. | | | | | | 28 | 10 | 58 | 160 | 189 | 263 | 219 | 196 | 53 | 56 | 1,222 |
| Extracted | | | | | | | | 2 | | | | | | 1 | | 3 |
| | | | | | | | *Girls: Initial Examination* | | | | | | | | | |
| No. of subjects | 2 | 4 | 14 | 10 | 7 | 2 | 2 | | | | | | | | | 41 |
| Teeth Present | | | | | | | | | | | | | | | | |
| Dec. | 36 | 78 | 280 | 199 | 130 | 36 | 29 | | | | | | | | | 788 |
| Perm. | | | | | 24 | 12 | 16 | | | | | | | | | 52 |
| Extracted | | | | | | | | | | | | | | | | 0 |
| | | | | | | | *Girls: Terminal Examination* | | | | | | | | | |
| No. of subjects | | | | 1 | | | 7 | 9 | 6 | 5 | 5 | 4 | 3 | 1 | | 41 |
| Teeth present | | | | | | | | | | | | | | | | |
| Dec. | | | | 20 | | | 73 | 72 | 36 | 31 | 4 | | | | | 236 |
| Perm. | | | | | | | 91 | 132 | 110 | 89 | 152 | 112 | 84 | 28 | | 798 |
| Extracted | | | | | | | | | | | | | | | | 0 |
| | | | | | | | *Average Number of Teeth Present at Successive Ages: All Examinations* | | | | | | | | | |
| AGE | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | |
| | | | | | | | *Boys* | | | | | | | | | |
| Dec. | 15 | 19 | 20 | 20– | 19 | 17+ | 14+ | 11+ | 9– | 6– | 3– | 0 | 0 | 0 | 0 | |
| Perm. | | | | | 3– | 6– | 9+ | 11+ | 15– | 18– | 25+ | 27 | 28– | 28– | 28 | |
| Total | 15 | 19 | 20 | 20– | 22 | 22 | 23+ | 23– | 23+ | 23+ | 28 | 27+ | 28 | 27 | 28 | |
| | | | | | | | *Girls* | | | | | | | | | |
| Dec. | 18 | 20– | 20– | 20– | 19 | 17– | 13 | 10 | 8– | 5– | 2– | 0 | 0 | 0 | | |
| Perm. | | | | | 3 | 6+ | 10 | 13+ | 16 | 19+ | 25– | 28– | 28– | 28 | | |
| **Total** | **18** | **20–** | **20–** | **20–** | **22** | **23** | **23+** | **23+** | **23+** | **24** | **26+** | **28–** | **28–** | **28** | | |

TABLE II. CARIES INCIDENCE IN TERMS OF AGE AND SEX

| | 3 YR. | | | 4 YR. | | | 5 YR. | | | 6 YR. | | | 7 YR. | | | 8 YR. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M. | F. | ALL | M. | F. | ALL | M. | F. | ALL | M. | F. | ALL | M. | F. | ALL | M. | F. | ALL |
| Number of subjects | 9 | 6 | 15 | 15 | 19 | 34 | 29 | 25 | 54 | 35 | 39 | 74 | 44 | 38 | 82 | 48 | 37 | 85 |
| DECIDUOUS DENTITION | | | | | | | | | | | | | | | | | | |
| Number present | 177 | 118 | 295 | 300 | 378 | 678 | 567 | 495 | 1,062 | 750 | 671 | 1,421 | 776 | 678 | 1,454 | 702 | 481 | 1,183 |
| Number carious | 48 | 49 | 97 | 71 | 130 | 201 | 151 | 175 | 326 | 231 | 232 | 463 | 248 | 281 | 529 | 292 | 246 | 538 |
| per cent carious | 27% | 41% | 33% | 24% | 34% | 30% | 27% | 35% | 31% | 31% | 35% | 33% | 32% | 41% | 36% | 42% | 51% | 45% |
| Number of DF surfaces: | | | | | | | | | | | | | | | | | | |
| Mean | 8.7 | 12.5 | 10.2 | 6.7 | 12.8 | 10.1 | 9.6 | 12.5 | 11.2 | 11.5 | 12.7 | 12.0 | 10.8 | 14.3 | 12.4 | 12.5 | 14.5 | 13.4 |
| Range, middle ½ of subjects | 2-11 | 3-16 | 3-15 | 2-13 | 4-17 | 3-16 | 2-16 | 5-20 | 2-17 | 6-17 | 3-18 | 5-17 | 9-20 | 6-14 | 6-18 | 9-20 | 6-14 | 6-19 |
| range, total | 0-37 | 0-42 | 0-42 | 0-17 | 0-27 | 0-27 | 0-34 | 0-43 | 0-43 | 0-36 | 0-30 | 0-36 | 0-33 | 0-25 | 0-33 | 0-37 | 0-27 | 0-37 |
| Subjects with no carious deciduous teeth | 2 | 0 | 2 | 3 | 2 | 5 | 6 | 4 | 10 | 5 | 3 | 8 | 5 | 1 | 6 | 3 | 2 | 5 |
| PERMANENT DENTITION | | | | | | | | | | | | | | | | | | |
| Number present | | | | | | | 0 | 8 | 8 | 112 | 106 | 218 | 268 | 243 | 511 | 449 | 388 | 837 |
| Number carious | | | | | | | 0 | 0 | 0 | 32 | 28 | 60 | 91 | 115 | 206 | 152 | 133 | 285 |
| per cent carious | | | | | | | | | | 28% | 26% | 27% | 34% | 47% | 40% | 34% | 34% | 34% |
| Number of DMF surfaces: | | | | | | | | | | | | | | | | | | |
| Mean | | | | | | | | | | 1.0 | 0.9 | 1.0 | 2.6 | 3.9 | 3.2 | 4.4 | 5.9 | 5.1 |
| Range, middle ½ of subjects | | | | | | | | | | 0-2 | 0-1 | 0-2 | 2-5 | 0-4 | 2-4 | 3-6 | 4-8 | 3-7 |
| Range, total | | | | | | | | | | 0-4 | 0-7 | 0-7 | 0-14 | 0-11 | 0-14 | 0-20 | 0-16 | 0-20 |
| Subjects with no carious permanent teeth | | | | | | | | | | 26 | 24 | 50 | 5 | 5 | 10 | 3 | 3 | 6 |
| TOTAL TEETH | | | | | | | | | | | | | | | | | | |
| Number present | 177 | 118 | 295 | 300 | 378 | 678 | 567 | 503 | 1,071 | 862 | 777 | 1,639 | 1,044 | 921 | 1,965 | 1,151 | 869 | 2,020 |
| Number carious | 48 | 49 | 97 | 71 | 130 | 201 | 151 | 175 | 326 | 263 | 260 | 523 | 339 | 396 | 735 | 444 | 379 | 823 |
| per cent carious | 27% | 41% | 33% | 24% | 34% | 30% | 27% | 35% | 31% | 30% | 33% | 32% | 32% | 43% | 37% | 38% | 44% | 41% |
| Number of DMF surfaces: | | | | | | | | | | | | | | | | | | |
| Mean | 8.7 | 12.5 | 10.2 | 6.7 | 12.8 | 10.1 | 9.6 | 12.5 | 11.2 | 12.4 | 13.7 | 13.0 | 13.4 | 18.2 | 15.6 | 16.9 | 20.5 | 18.4 |
| Range, middle ½ of subjects | 2-11 | 3-16 | 3-15 | 2-13 | 4-17 | 3-16 | 2-16 | 5-20 | 2-17 | 6-20 | 5-20 | 5-20 | 13-26 | 9-18 | 10-23 | 11-24 | 12-27 | 11-26 |
| Range, total | 0-37 | 0-42 | 0-42 | 0-17 | 0-27 | 0-27 | 0-34 | 0-43 | 0-43 | 0-36 | 0-36 | 0-36 | 0-39 | 0-33 | 0-39 | 0-27 | 0-37 | 0-37 |
| Subjects with no carious teeth | 2 | 0 | 2 | 3 | 2 | 5 | 6 | 4 | 10 | 5 | 3 | 8 | 5 | 1 | 6 | 3 | 1 | 4 |

TABLE II.—Cont'd

| | 9 YR. | | | 10 YR. | | | 11 YR. | | | 12 YR. | | | 13 YR. | | | 14 YR. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M. | F. | ALL | M. | F. | ALL | M. | F. | ALL | M. | F. | ALL | M. | F. | ALL | M. | F. | ALL |
| Number of subjects | 47 | 29 | 76 | 37 | 20 | 57 | 39 | 16 | 55 | 27 | 9 | 36 | 15 | 7 | 22 | 9 | 4 | 13 |
| DECIDUOUS DENTITION | | | | | | | | | | | | | | | | | | |
| Number present | 529 | 310 | 839 | 336 | 152 | 488 | 237 | 72 | 309 | 74 | 16 | 90 | 8 | 0 | 8 | 3 | 0 | 3 |
| Number carious | 273 | 172 | 445 | 218 | 99 | 317 | 145 | 50 | 195 | 48 | 14 | 62 | 5 | | 5 | 2 | | 2 |
| per cent carious | 52% | 55% | 53% | 65% | 65% | 65% | 61% | 70% | 63% | 65% | 88% | 69% | 62% | | 62% | 67% | | 67% |
| Number of DF surfaces: | | | | | | | | | | | | | | | | | | |
| Mean | 12.8 | 13.7 | 13.1 | 13.1 | 8.5 | 12.8 | 8.8 | 9.5 | 9.0 | 3.1 | 3.6 | 3.3 | 0.6 | | | 0.3 | | |
| Range, middle ½ of subjects | 8-17 | 3-20 | 7-18 | 8-18 | 5-16 | 5-17 | 5-9 | 3-7 | 3-10 | 0-5 | 0-9 | 0-6 | | | | | | |
| range, total | 0-28 | 0-37 | 0-37 | 0-25 | 0-31 | 0-31 | 0-24 | 0-29 | 0-29 | 0-25 | 0-12 | 0-25 | 0-10 | | | 0-3 | | |
| Subjects with no carious deciduous teeth | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| PERMANENT DENTITION | | | | | | | | | | | | | | | | | | |
| Number present | 545 | 397 | 942 | 579 | 319 | 898 | 714 | 313 | 1,027 | 644 | 238 | 882 | 404 | 194 | 598 | 248 | 111 | 359 |
| Number carious | 179 | 128 | 307 | 178 | 107 | 285 | 206 | 104 | 310 | 176 | 90 | 266 | 152 | 98 | 250 | 88 | 43 | 131 |
| per cent carious | 33% | 32% | 33% | 31% | 34% | 32% | 29% | 33% | 30% | 27% | 38% | 30% | 38% | 50% | 42% | 35% | 39% | 37% |
| Number of DMF surfaces: | | | | | | | | | | | | | | | | | | |
| Mean | 6.1 | 7.4 | 6.6 | 8.0 | 9.7 | 8.6 | 8.8 | 12.6 | 9.9 | 10.2 | 16.3 | 13.3 | 16.5 | 23.7 | 18.8 | 16.2 | 17.2 | 16.5 |
| Range, middle ½ of subjects | 4-7 | 5-10 | 4-8 | 5-10 | 7-10 | 5-9 | 5-10 | 6-16 | 5-12 | 4-15 | 10-21 | 5-16 | 7-25 | 21-23 | 8-25 | 12-28 | 18-21 | 12-20 |
| Range, total | 0-29 | 0-15 | 0-29 | 0-31 | 2-23 | 0-31 | 0-32 | 4-30 | 0-32 | 0-36 | 8-35 | 0-37 | 5-32 | 12-40 | 5-40 | 9-32 | 7-23 | 7-32 |
| Subjects with no carious permanent teeth | 1 | 1 | 2 | 1 | 0 | 1 | 0 | 3 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL TEETH | | | | | | | | | | | | | | | | | | |
| Number present | 1,074 | 707 | 1,781 | 915 | 471 | 1,386 | 951 | 385 | 1,336 | 718 | 254 | 972 | 412 | 194 | 606 | 251 | 111 | 362 |
| Number carious | 454 | 300 | 754 | 396 | 206 | 602 | 351 | 154 | 505 | 224 | 104 | 326 | 157 | 98 | 255 | 90 | 43 | 133 |
| per cent carious | 42% | 42% | 42% | 43% | 44% | 43% | 37% | 40% | 38% | 31% | 41% | 34% | 38% | 50% | 42% | 36% | 39% | 37% |
| Number of DMF surfaces: | | | | | | | | | | | | | | | | | | |
| Mean | 18.9 | 20.2 | 19.4 | 20.8 | 20.8 | 20.8 | 16.7 | 22.1 | 17.7 | 14.0 | 21.6 | 15.9 | 17.1 | 23.7 | 19.2 | 16.6 | 17.2 | 16.8 |
| Range, middle ½ of subjects | 13-24 | 12-28 | 12-25 | 15-28 | 15-23 | 13-27 | 8-22 | 12-20 | 10-22 | 6-21 | 19-23 | 9-22 | 7-17 | 21-23 | 8-23 | 12-28 | 18-21 | 12-20 |
| Range, total | 0-44 | 0-47 | 0-47 | 3-44 | 2-33 | 2-44 | 3-34 | 5-43 | 3-43 | 0-36 | 8-35 | 0-36 | 5-51 | 12-33 | 5-51 | 9-32 | 7-23 | 7-32 |
| Subjects with no carious teeth | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

a period of at least five months' duration were not included. Lesions of the deciduous and permanent teeth are listed separately and in combination.

Figs. 1 and 2 portray the individual long-term dental records of each subject, with separate listing of the sixty boys and the forty girls, respectively.*

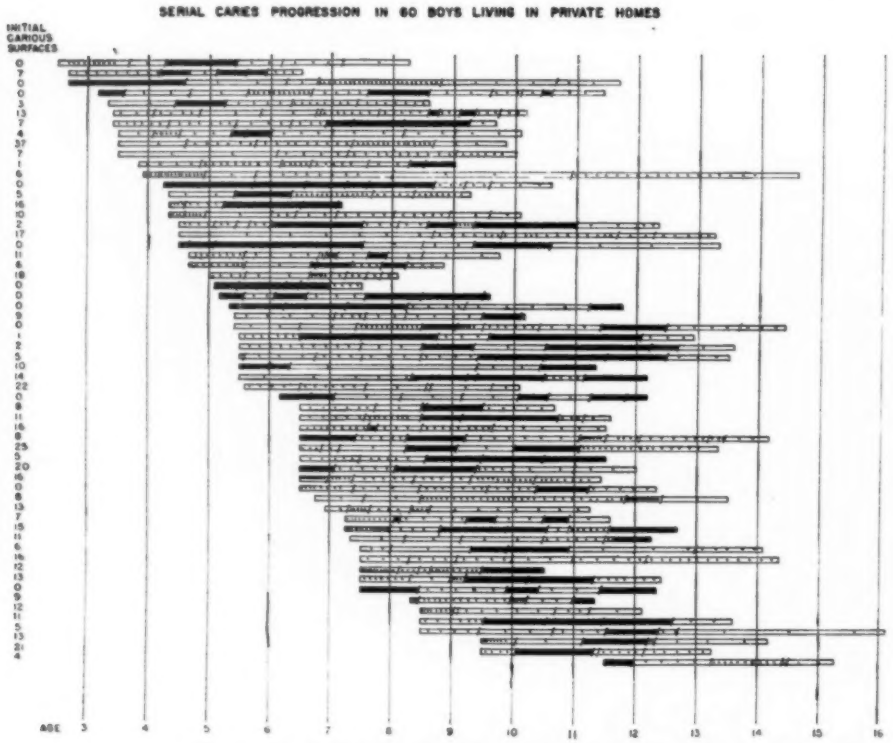


Fig. 1.—A diagrammatic representation of the serial dental status of 60 boys. Each horizontal bar portrays one subject's record. The position and length of the bar indicate age and the duration of observation. Oblique lines indicate interim dental examinations. Black areas indicate periods during which no newly carious areas were detected. The number of dots within unshaded segments of a bar indicate the number of newly carious surfaces detected at the close of the corresponding interval. The figure at the left of each bar indicates the number of DMF surfaces in the mixed dentition at the time of the earliest examination.

In these two charts, each horizontal bar represents the course of observation for an individual subject. Interim dental examinations are indicated by oblique lines through the horizontal bars; the number of newly carious surfaces developing between successive examinations are indicated by the number of dots within the segments of the bars. Areas shaded black represent periods during which no new caries was observed. The extent of caries for each child at the earliest examination is indicated by the figure at the left of each bar, expressed as the total number of affected deciduous and permanent tooth surfaces.

*In constructing Fig. 2, the record of one girl was inadvertently omitted.

3. *Average Incidence of Caries.*—Figs. 3 and 4 portray graphicly the data from Table II relating to the average incidence of carious tooth surfaces at progressive age levels. Fig. 3 indicates the average incidence of decay in both the deciduous and permanent teeth, and indicates the proportion each dentition contributes to the caries score. Fig. 4 relates to the permanent teeth only, but it indicates the proportion of the affected tooth surfaces which were contributed by lesions of the first permanent molar teeth. Of the 1,282 carious surfaces observed in permanent teeth, 800, or 62 per cent, were found in the first molars.

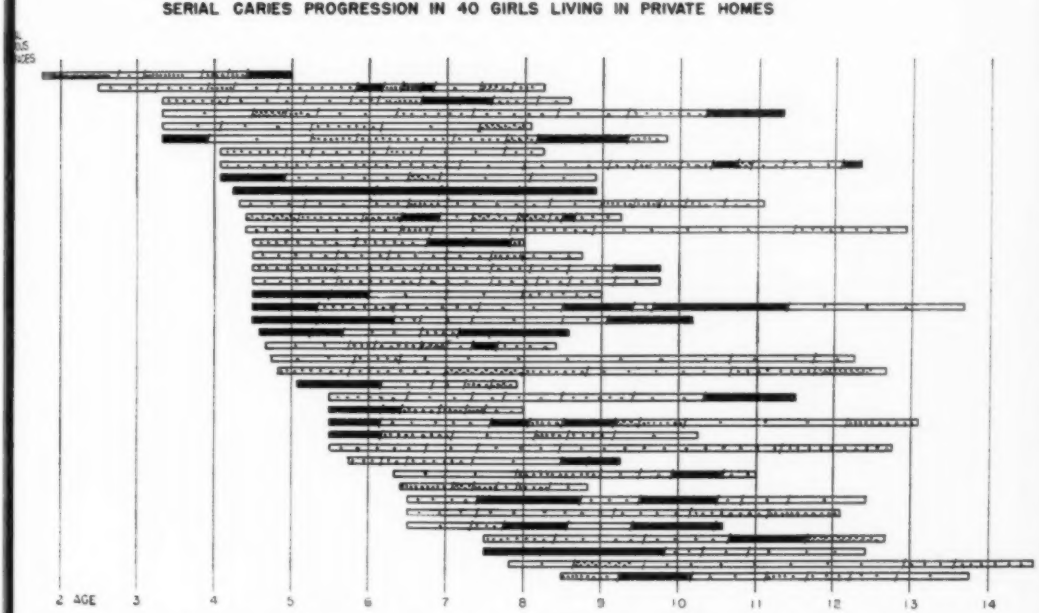


Fig. 2.—A diagrammatic representation of the serial dental status of 40 girls. The meaning of the symbols is described under Fig. 1.

The average values for caries scores do not reveal the wide dispersion of values noted in each age group. To express the predicted range of values for the middle one-half of the subjects in any age group, one should use approximately the stated average plus or minus six. The data relating to the range of values are included in Table II.

*Extent of Caries in Affected Teeth:* One may estimate the extent of caries not only on the basis of the number of surfaces affected by decay, but also from the ratio between the observed number of DMF surfaces and the number of DMF teeth. In our subjects, at the age of 6 years, this ratio averaged 1.25 affected surfaces for each affected tooth. During the following three years the ratio rose sharply to approximately 1.75:1, and oscillated near that level for the subsequent years.

*Incidence of Freedom From Caries:* Table II shows that the incidence of children who were entirely caries-free was low throughout the whole series. The proportion of those free from caries diminished rapidly with age progression; after the age of nine years, only a single child was entirely free from caries and his earlier record had shown caries of the deciduous teeth. In terms of caries incidence in relation to the total number of teeth in the mouth, it will be noted that approximately one-third of the teeth present at each age level showed decay.

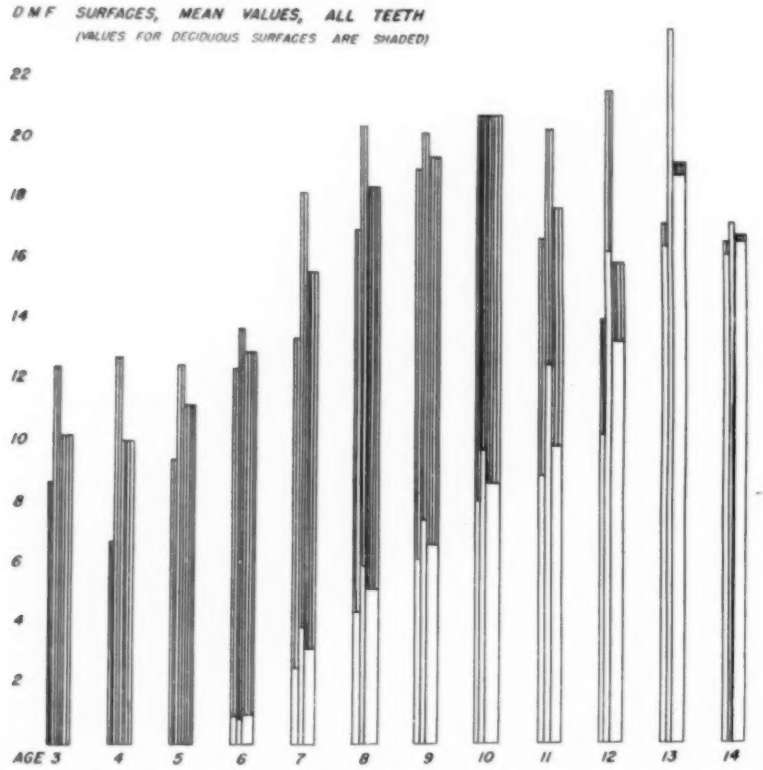


Fig. 3.—The average extent of caries in the mixed dentition at successive ages. For each age the values for boys, girls, and the combined sexes are shown, respectively, in the three columns, reading from left to right. Values for deciduous teeth are shown in the shaded areas; they are expressed in terms of the number of surfaces with decay or fillings. Values for permanent teeth include also the score for extracted teeth, each rating as 3 affected surfaces.

*Tooth Mortality:* Loss of permanent teeth through extraction was remarkably low in the whole series. Only 2 of the 101 subjects had lost permanent teeth through extraction. In one of these, two incisors had been lost as the result of a fall from a horse. The other child lost a first permanent molar which already was extensively carious the first time he was examined.

4. *Rate of Progression of Caries.*—During the course of observation, an aggregate of 2,248 newly carious surfaces was discovered: this includes 1,053

in deciduous and 1,195 in permanent teeth. Thus the average annual increment of caries was 3.83 newly carious tooth surfaces per annum; the standard deviation was 2.09, and the standard error of the mean, 0.22. These values reflect the wide variation to be observed in the individual rates. As the data will show, this deviation is notable not only from one subject to another, but for the same subject at different segments of his course of observation. The dispersion of values is shown in Figs. 1 and 2, and in the various parts of Fig. 5.

5. *Variability of Rate of Caries Progression.*—Fig. 5 deals with the frequency distribution of the individual rates of annual caries increment among

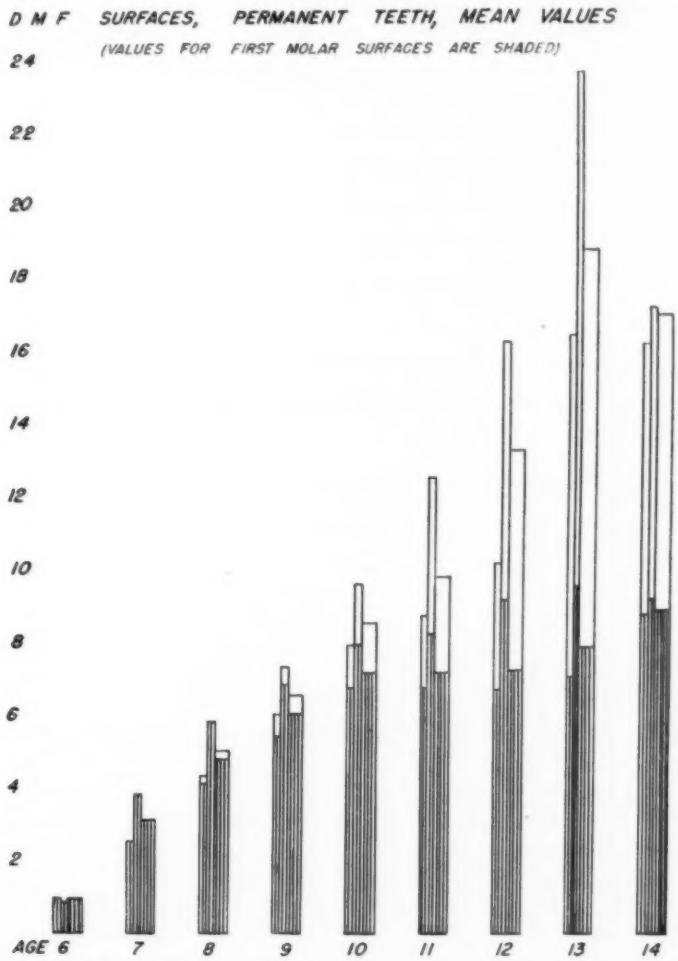


Fig. 4.—The average extent of caries in the permanent teeth at successive ages. For each age the values for boys, girls and the combined sexes are given, respectively, in the three columns, reading from left to right. Values are expressed in terms of the number of affected surfaces, as described under Fig. 3. The number of affected surfaces found in the first permanent molars is indicated by the length of the shaded portion of each column.

the subjects throughout the periods of observation. Each of the bars in Fig. 5 shows the median increment rate, together with the range of values observed in the middle one-half, and in the outer tenths of each group. Fig. 5 is subdivided into sections numbered serially from 1 through 4, each section relating to different groupings of the subject personnel.

**NEW DMF SURFACES PER ANNUM: DECIDUOUS AND PERMANENT TEETH RANGE AND FREQUENCY DISTRIBUTION OF INDIVIDUAL AVERAGE VALUES**

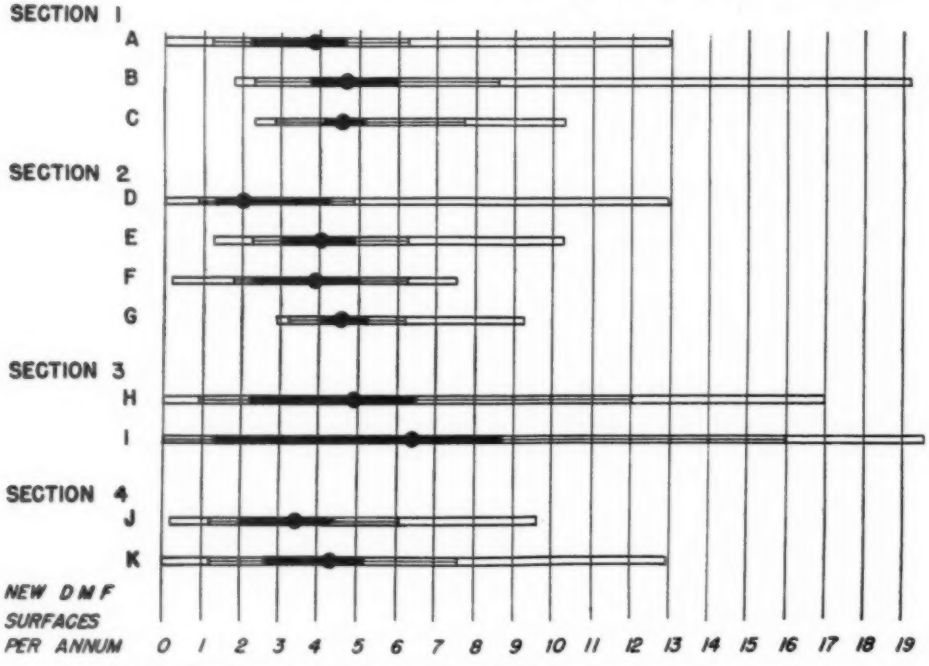


Fig. 5.—Frequency distribution of caries increment rates (the average number per annum of newly carious surfaces in the mixed dentition for each subject). Bar *A* represents the range of values for the whole group of subjects throughout the total duration of individual observation. The remaining bars deal with various segments, both of the subject personnel and of the duration of individual observation, as defined in the text.

In each bar, the black circle indicates the median value. The zone shaded black represents the range of values for the middle one-half of the subjects. The unshaded zone represents the range of values observed among the outer tenths of the respective group.

*Over-All Rate of Caries Progression:* (Section 1) Bar *A* shows the rates of caries increment observed among the whole group of subjects throughout the total duration of observation periods. It indicates that the individual whose average annual rate of caries increment placed him midway between the child with the lowest and the child with the highest rates had an average increment rate of 3.8 newly carious tooth surfaces for each year of observation. Further, it shows that one-half of the total group had average increment rates which ranged between 2.2 and 4.7 new DMF surfaces per annum; that 10 per cent of the group had values which ranged from none to 1.3, whereas another one-

tenth had values ranging from 6.2 to 12.9. Bar *B* offers similar data, but in it the total period of time used in estimating the average increment rate did not include those periods during which no new caries developed (represented as the black segments in Figs. 1 and 2). Bar *C* includes only those subjects who showed no periods during which caries had not advanced.

*Relation of Increment rate to Earlier Incidence of Caries:* Section 2 of Fig. 5 shows the relationship between the initial extent of caries in the individual mouth and the subsequent average rate of caries progression. The subjects were arranged in order of their initial caries scores (left-hand columns, Figs. 1 and 2) and then divided into fourths. The rate of average caries progression is shown separately for each one-fourth of the total group in bars *D*, *E*, *F*, and *G*, relating, respectively, to those with the lowest through to the highest initial caries incidence.

In Section 3 of Fig. 5, the middle one-half of subjects (those portrayed in bars *E* and *F*) have been subjected jointly to further analysis to determine the effect of the duration of observation period on the average rate of caries progression. The middle one-half was chosen for this analysis in preference to the total subject population, so as to portray more closely the response one may expect in the average child rather than in either outgroup. In bars *E* and *F*, the range was expressed in terms of the total duration of observation for each subject. In bar *G*, only the initial year or two of observation was used in calculating the individual average annual caries increment. In bar *H*, only the interval between the first and second dental examinations was used in computing the average increment; further, only those subjects are included whose intervals between the first and second examinations ranged between 3 and 11 months.

Sections *1*, *2*, and *3* of Fig. 5 are based on the combined values for the two sexes. Section *4* presents the ranges of observed values for boys and for girls separately. Bars *J* and *K* correspond with bar *A* as to the subjects included and as to the duration of observation. The differences will also be discussed.

Reviewing the substance of Fig. 5 as a whole, it is apparent that caries of the mixed dentition progressed in the representative subject at the average rate of almost 4 newly affected surfaces per annum, even though the subjects were under recurrent dental care. The average increment rate was least among those children who initially had the least caries experience, and highest in those whose early caries experience had been the greatest. The shorter the period of observation, the higher the average increment rate: when the period of observation did not exceed 11 months, the median rate noted was almost 6½ newly carious surfaces per annum. The median average rate for boys was less than that for girls: 3.4:4.3. The corresponding arithmetical means show a corresponding and statistically significant difference. The lack of homogeneity of findings, evident even within the subgroups, is illustrated by the variable range observed in the middle one-half of the subjects. Those who initially had the highest caries experience (bar *G*) showed the greatest homogeneity (the smallest range of values), whereas the group with the least caries at the beginning (bar *D*) showed the greatest inconstancy among its constituents as to increment

rates. The degree of dispersion increased greatly when the total periods of observation were segmented, as illustrated in bars *H* and *I*.

*Significance of Sex Differences in Increment Rates:* In view of the sex distinctions noted, further studies were made to rule out the possible effect of chronological and of dental ages on the observed differences. Table III shows the observed average annual caries increment rates for boys and for girls at successive ages from 5 through 13 years. With but two exceptions, the average values were consistently and notably higher for girls than for boys not only for respective years but throughout the total age span studied. Our data relating to caries progression in terms of posteruptive tooth age will be presented in another report; the trends observed will be discussed subsequently in this presentation.

TABLE III. AVERAGE ANNUAL CARIES INCREMENT RATES IN TERMS OF SEX AND OF AGE OF SUBJECTS (DMF SURFACES PER ANNUM)

| AGE RANGE | 5 TO 6 | 6 TO 7 | 7 TO 8 | 8 TO 9 | 9 TO 10 | 10 TO 11 | 11 TO 12 | 12 TO 13 |
|---|---|---|---|---|---|---|---|---|
| Boys | 3.9 | 3.2 | 3.7 | 3.4 | 3.7 | 3.1 | 2.9 | 2.9 |
| Girls | 4.1 | 4.0 | 5.8 | 4.8 | 3.9 | 4.1 | 2.8 | 4.5 |

*Inconstancy of Successive Annual Caries Increment Rates for the Given Individual:* The foregoing analyses reflect the variability of caries advance among the different subjects. Similar variability was noted during the course of observation of the individual subject. This is apparent from Figs. 1 and 2. Further analysis was made to determine the degree of constancy of the individual's percentile rating of caries extent observable at the time of his serial examinations. To offer the greatest possible number of subjects for the analysis, 8 years of age was chosen as the age of reference. Children whose total caries incidence at that age placed them in the middle one-half of the group were studied as to their quartile position for caries extent at 6 and at 10 years of age. Sixty per cent of those in the middle one-half of the group at 8 years of age were also in that range at 6 or at 10 years of age, or both. The remaining 40 per cent were about equally divided between the first and fourth quarters of the group. Such distribution corresponds to what one would expect to find through factors of chance in any population. Moreover, the range of values encompassed by the middle one-half of the group is so wide that little homogeneity exists within that group. These ranges were from 5 to 20, 12 to 27, and 13 to 27 DMF surfaces at the respective ages of 6, 8, and 10 years.

The inconstancy in the regularity of advance of caries in the individual subject can be illustrated further, through consideration of the duration of nonadvance of caries in the individual subjects. In the aggregate, extension or initiation of caries was noted during 5,271 of 6,839 months of observation in our 101 subjects. This represents about 73 per cent of the time. Of the 1,568 months during which no advance of caries was detectable, 1,180 months represented consecutive periods, whereas the remainder comprised intermittent segments of variable duration interspersed with periods of advancing caries. Approximately 90 per cent of the cumulative consecutive nonadvance was made up of periods of more than 10 months each. Periods of such length were ob-

served in more than one-half the total number of subjects. The subjects grouped themselves essentially into fourths in regard to their demonstrable nonadvance of caries. About one-fourth showed no period of nonadvance of any duration; newly carious surfaces were demonstrated at the time of each recurrent examination. Another one-fourth had periods aggregating less than 12 months with no caries advance. One-fourth had periods ranging from 12 to 24 months with no caries advance, and the remaining one-fourth were clinically free from advancing caries for periods of two years or longer. Prolonged nonadvance (12 months or longer) was observed at some stage of observation in 60 per cent of the boys, but in only 42 per cent of the girls.

## DISCUSSION

This study was designed to serve as a background for future investigations concerning caries control. Before studying caries progression in children living under imposed environmental conditions, it is important to know the predictable response when no control has been imposed. For economy and efficiency of effort, the experimenter should know the degree of deviation to be expected in an uncontrolled group, and recognize the factors which may lead toward deviant results. From such knowledge he can determine more nearly adequately the number of subjects and the duration of observation needed to assure validity to his data. Working toward these objectives in the current study, it was necessary to devise a pattern for the study of caries experience based on long-term examinations of individual children in contrast to the commoner technique of using cross-sectional observations without maintaining the identity of the individual subjects. Because our subject personnel included children in various stages of dentition, it has been necessary to employ techniques which portrayed caries progress both in the deciduous and the permanent dentition. The method employed seems adequate for the purpose.

From a review of our data, one may characterize the caries course of our subjects as follows:

1. Caries was practically universal among the members of the group.
2. Practically without exception, caries tended to progress during the periods of observation.
3. Recurrent dental care did not halt the progression of caries, but it served to prevent the loss of teeth.
4. The rates of progression of caries differed widely among the different subjects, and in the same child from time to time during the individual periods of observation. Data are not available to permit thorough analysis of the reason or reasons for this fluctuation in rates of caries extension. Some of the recognized constants and variables which characterized the environment of the subject population will be discussed later.
5. The serial course of caries progression for the individual child is not portrayed through the average values for caries in terms of age or sex, or by the average rates for caries progression. Only through individualization of long-term dental records was it possible to picture the pattern of caries in the individual subject.

Is the volume of data sufficient to define the caries characteristics of a population? Such a question is relevant, in view of the inconstancy of the data. As a measure of the incidence of caries for children of given age and sex, many more values would be desirable. It is especially regrettable that our data do not include many values for children in their teen years. From the viewpoint of annual caries increment, however, it seems doubtful whether greater accuracy would be obtained from larger numbers of subjects. Surely the average duration of observation for each child and the minimum number of dental examinations in each record are sufficient to insure accuracy of record and of observation for each child.

To learn the effect of the size of sample and the duration of observation on the average results obtained, we have compared the average response for the group as a whole with the corresponding average for segments of the total population studied, and for segments of the total periods of observation. In part, this was presented in the preceding section. Without stating the results in detail, it may be said that the number of subjects could be reduced by one-half or even more, without introducing serious deviation from the whole group average for caries increment rate. On the other hand, when the increment rate was determined using fractions of the total periods of observation, great inconstancy of the average increment rate was obtained. It became apparent that little could be deduced of an individual's average long-term increment rate through values from observation periods of less than six months. Further, it seemed doubtful whether such short periods of observation would be sufficient to reflect clearly any change in caries propensities, such as might be attributed to imposed experimental conditions. Until more is known of the latency of development of caries lesions, it will be well to assume that several months are necessary to make apparent any potentialities for caries advancement or retardation, using the usual clinical methods of appraisal.

Caries increment rates determined for intervals of approximately one year's duration showed greater constancy than for shorter intervals, but tended to a higher average value than when a still longer period was used as a basis for calculation. For practical purposes we believe that a year of recurrent observation of the given subject would provide a valid estimate of his current caries propensities. From a group of about thirty individuals so studied, one should be able to deduce statistically valid estimates as to caries progression rates during an equal period for a larger similar population. For economy of effort and for coherence of results, we believe that the ideal experimental or control group of children would be of the same sex and age, and of similar caries experience prior to the projected study.

Aberrations in rates of caries progression between different children may be due to various factors, acting separately or in combination. Some such factors could explain the variable rate seen in a given subject at different periods of his observation. If one may assume that the child's caries pattern will reflect his manner of living, then one would expect that with the passage of time and season, and with changes either in the child's practices of eating, his level of health, or in other matters relating to hygiene, his current rate of caries pro-

gression might fluctuate. If our subjects had lived under imposed conditions of regimentation, their caries progression rates might well have been less erratic. In a study similar to the one herein reported, but dealing with the caries course of diabetic children, there was but slight progression of caries in any subject, and the degree of deviation both for the individual and for the group as a whole was minimal.[1] Those children were living under conditions much more nearly regimented than is possible to obtain with the usual child population.

We have no data of the diet habits of the children used in this study, but we may infer that they were as diverse as in any similarly uncontrolled group of children, and that suboptimal intake of specific nutrients was prevalent.[2] We recognize and wish to emphasize that we have studied a picked group of children, chosen from the clientele of a dental clinic. Such sampling, of itself, would affect our quantitative results. One must not assume, however, that these children had come to the clinic primarily because of their dental needs. Many of them came as a part of the "Iowa Dental Plan," in accordance with which each school child is asked by the school authorities to take a card to his dentist annually and have the dentist certify either that no dental therapy is needed, or else that the necessary services have been performed. Children with minimum dental needs might be expected to report with less regularity than would children with symptoms referable to the teeth. Possibly the general school population would have included an appreciably larger proportion of children who were free from caries.

Has fluoride ingestion played a significant part in the caries experience of these children? Probably the children used in this study have received insignificant amounts of fluorides from the domestic water supply. Most of the subjects had been born in Iowa City and had lived there continuously. Iowa City receives its water supply from the Iowa River, after the raw water has been filtered through galleries and then clarified. Whereas as much as 2 parts per million of fluorine has been reported from wells used by the University for industrial purposes, the domestic water supplies for the community have been reported fluorine-free or to contain at most a trace.[3] Probably from the evidence at hand, it would be generally agreed that the water as consumed in this locality does not contain sufficient fluoride to affect caries control significantly.

To what degree do the reported dental findings relate to the child population at large? Our data portray the pattern of caries progression in a specific group of children. One should not infer that the data would apply equally well in their quantitative aspects to the average Iowa school population, until our findings have been compared with such a population. However, even though our subjects may not necessarily represent a community average, this does not lessen the value of their individual records for study. The caries course as exemplified by a given subject can be used as a basis for comparison with the course of other children of similar description. Conclusions, as they relate to the manner of progression of caries, should be valid for children from any group or locality.

For general comparison, the data from Klein and Palmer's[4] study of children from Hagerstown, Md., have been employed. Their study was thorough and comprehensive, made with a constant examining personnel, and dealt with children of a community similar in many respects to Iowa City. The notable distinction between the studies is that theirs is cross-sectional, based on a single examination of each mouth.

TABLE IV. STATUS OF PERMANENT TEETH OF CHILDREN FROM DENTAL CLINIC COMPARED WITH THAT OF CHILDREN FROM HAGERSTOWN, MD.[4]

| | CHILDREN FROM DENTAL CLINIC | HAGERSTOWN SCHOOL POPULATION |
|---|---|---|
| Number of permanent teeth present, aggregate of terminal examinations | 2,012 | |
| Number of these with DMF lesions | 695 | |
| Proportion of teeth which were carious | 35% | 15% |
| Number of surfaces with DMF lesions, aggregate of terminal examinations | 1,282 | |
| Average number of DMF surfaces for each DMF tooth | 1.85 | 1.93 |
| Average incidence of DMF surfaces for each child at terminal dental examination: | | |
| (Average age, Iowa City children, 130 months) | 6.9 | |
| (Average age, Hagerstown children, 125 months) | | 5.5 |
| Proportion of DMF surfaces located in first permanent molar teeth | 59% | 78% |
| Incidence of extracted permanent teeth: | | |
| Proportion of children who had lost one or more permanent teeth | 2% | 18% |
| Ratio of extracted teeth to DMF teeth | 0.04% | 10% |
| Average annual increment of DMF surfaces: | | |
| Dental clinic (observed) | 2.7 | |
| Hagerstown value (computed) | | 1.3 |

Table IV offers a summary contrasting the Iowa City to the Hagerstown studies. From that table it is evident that our subjects had the higher average caries incidence rate for permanent teeth and the more rapid apparent rate of caries progression. It will be recalled, however, that in the Hagerstown study the stated increment rate was calculated through interpolation rather than observation. The average apparent extent of caries in the average affected tooth is similar for each group, in so far as the extent of caries can be measured from the number of DMF surfaces alone. However the incidence of extracted teeth is notably higher in the Hagerstown group, this implying at first glance that the severity of caries or its steadiness of progression had exceeded that in the Iowa City subjects. The lesions found in the first permanent molars by Klein and Palmer comprise a much higher proportion of the total lesions than was found in the Iowa City children. This distinction may be more apparent than real, dependent on the manner of weighting the values for extracted teeth in the Hagerstown study. Klein and Palmer assumed that each extracted permanent tooth had experienced caries in all five exposed surfaces prior to extraction, and scored such teeth accordingly. If such teeth had remained unextracted and untreated, the DMF score might have been considerably less than their estimate. Possibly the actual extent of destruction of first molar teeth in the contrasted series of children was not greatly different, because the incidence of extraction may reflect the type of dental care their subjects had received.[5, 7]

If the incidence of DMF surfaces for permanent teeth in the Hagerstown children is less than has been estimated by Klein and Palmer, then the disparity between the DMF scores in the Iowa City and the Hagerstown groups becomes still greater than already has been pointed out.

The examining techniques employed by Klein and Palmer were basically the same as those used routinely in our Children's Clinic. Important, however, is the fact that the Dental Clinic examinations were preceded by a thorough prophylactic cleaning of the teeth. In the absence of such preliminary cleaning, and with shortening of the examination period, one would expect to miss some of the smaller dental lesions.

During the summer of 1944, we had an opportunity to compare dental records made in the course of a general school survey with records of the same mouths made concurrently by our own dentist.* The routine school examination for each child was completed in less than five minutes, whereas our examiner required from fifteen to twenty-five minutes for each examination and its recording. In other respects the techniques of examination were comparable. The DMF scores for individual children varied widely in the two examinations, often by as much as 100 per cent, and averaged 50 per cent higher for the longer examination procedure.[6]

From the data as they stand, we conclude that the Iowa Dental Clinic group of children had a higher incidence of caries than did the Hagerstown group, but that the individual dental lesions were less severe and that tooth mortality was much lower in the Iowa city group. One would expect the higher incidence of minor lesions with the technique employed. The relationship between the mortality of teeth and the degree of dental service received earlier by the examined group will be discussed elsewhere.[7] It is reasonable to attribute the low loss of teeth in the Iowa City subjects to the recurrent dental therapy.

The girls of this series had significantly higher incidence of carious surfaces than did the boys. Klein and Palmer made similar observations, and attributed the distinction to the fact that at a given age girls are more precocious than boys in the time of eruption of teeth, and consequently the teeth have been exposed to caries-promoting agencies in the mouth for longer periods of time. They concluded that girls as a sex show no greater susceptibility to caries than do boys.[8] Our data indicate that the girls as an average not only had more caries than boys at given age levels, but also that they had higher average caries increment rates than did the average boy. Unpublished data from this study show that the same distinction prevails when one studies the rate of advance of caries in first permanent molar teeth, basing calculations, not on the chronological age of the subject but instead, on the number of months which had elapsed following the appearance of four first permanent molars in the mouth of each individual subject. The apparent sex difference in caries pattern is illustrated in this study through data from Tables II and III, in Figs. 1 and 2, in bars *J* and *K* of Fig. 5, and in the lessened incidence of periods of nonadvance among girls which was cited in the last paragraph of the section on presentation of

*Dr. Wah Leung, whose services were made available to us through the courtesy of Dr. Harold Hodge of the University of Rochester and the Carnegie Corporation.

data. We do not imply that tooth age does not play a part in the likelihood of caries progression. Moreover, we believe that there is no established and inherent tendency for girls to tend toward greater caries experience than boys. Our data make it necessary, however, to supplement the tooth age concept as a predisposing factor toward caries with added theories as to why one sex tends to show more rapid progression of caries. One may postulate that as a group, girls are inclined to give less consideration to good habits of eating than are boys. Our observations support such a concept, and lead us to believe that advance of caries is favored by such dereliction. With regimentation of eating habits, sex distinction in caries progress was not noted among diabetic children.[1]

## SUMMARY AND CONCLUSIONS

The long-term course of dental caries in a large group of children has been presented. Caries was practically universal in the members of the group, and the tendency to progress with the passage of time likewise was almost universal. The average rate of increment approximated four tooth surfaces per annum. The loss of teeth through decay, however, was negligible. Prevention of tooth mortality may be credited to the recurrent dental service the children were receiving. It is significant that such dental therapy did not prevent initiation of new areas of decay. The serial course of each child's caries was erratic, typically being interrupted by intervals during which no new advance could be detected. The nature of the data emphasizes the need for long-term studies of caries progression in individual children as a measure of effectiveness of caries control, in contrast to the cross-sectional methods of caries survey which have been commonly employed.

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# THE INFLUENCE OF HUMAN SERUM ALBUMIN ON EDEMA IN ERYTHROBLASTOSIS FETALIS

MENDEL JACOBI, M.D., ABRAHAM LITVAK, M.D., AND SEYMOUR GRUBER, M.D.
BROOKLYN, N. Y.

THE TREATMENT of erythroblastosis fetalis has become important with the more general recognition of the disease in recent years and under the stimulus of increasing knowledge of its pathogenesis. Routine typing of expectant mothers for the Rh factor has resulted in earlier diagnosis of the disease and in more effective therapy.[1] The treatment has been, for the most part, aimed at combatting the anemia by means of blood transfusions; there has been no attempt directed specifically at the reduction of the marked edema present in the majority of the more severe cases. Wiener and his co-workers[2] clearly state this, "Blood transfusions are not the complete answer to the problem of the treatment of hemolytic anemia of the newborn, even when the infants appear to be in good condition at birth. Transfusions are merely a substitution therapy and therefore save only those infants who would otherwise die from extreme anemia brought about by the destructive action of the maternal isoantibodies." It has never been shown that anemia is the most important cause of death. In a recent review of 58 cases, Leonard[3] has shown that fatalites occurred in infants treated by transfusion who had hemoglobin values, on admission, from 9 to 23 Gm., with an average of 13 Gm. A study of her statistics shows 6 of 12 infant deaths with clinical edema, and the author clearly points out that, "Marked edema is . . . recognized as a grave prognostic sign."

We have had similar experience and have felt that the edema is not due to anoxemia, as is the commonly accepted belief, but is, rather, associated with a lowered osmotic pressure because of low blood protein levels. This would be expected as a result of the liver damage found so regularly, particularly in the more severe cases of erythroblastosis fetalis. We recently had the opportunity of treating empirically, with concentrated human serum albumin, one of twins presenting severe generalized edema incident to marked erythroblastosis. The treatment was undertaken as a last resort and proved dramatically efficacious in reducing the edema after previous transfusions had failed entirely in this respect, and eventuated in the infant's complete recovery. His twin sibling, given only transfusions, died 54 hours after delivery even though the clinical and laboratory evidences of erythroblastosis were milder than in the serum albumin-treated child.

We subsequently treated another case of erythroblastosis fetalis complicated by marked pitting edema with the same excellent results. Biochemical studies in this case indicate that the edema occurred when there was a fall in the blood protein level, and that this fall was corrected by the administration of the serum albumin. With the restoration of the blood proteins the edema

From the departments of pathology and pediatrics, Beth-El Hospital.

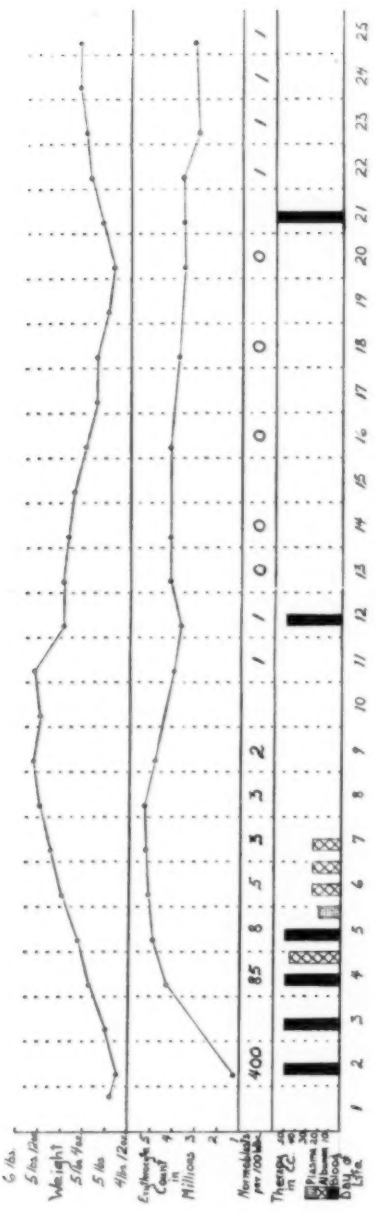


Fig. 1.—Course of Infant B (Case 1).

disappeared. Positive cephalin flocculation tests and a markedly prolonged prothrombin time were indicative of severe liver damage.

## CASE REPORTS

CASE 1.—Male twins were born to Mrs. F. C. at 11:55 P.M. on Dec. 7, 1945. The first child weighed 4 pounds 15 ounces, and the second, 5 pounds 10 ounces. The following morning both infants were markedly jaundiced. An enlarged liver and spleen could be palpated in each child. We shall designate the first and smaller infant "B," and the second and larger infant "A," for that was subsequently found to be their blood types. Both infants were Rh positive. The mother was type AB, Rh negative. The father was type O, Rh positive.

Initial study of the infants' blood showed the following:

| | B | A |
|---|---|---|
| Hemoglobin | 7 Gm. | 14.5 Gm. |
| Erythrocytes | 1,250,000 | 4,100,000 |
| Leucocytes | 400,000 | 35,000 |
| Normoblasts per 100 Wbc | 400 | 9 |

Each child was immediately given a transfusion of 50 c.c. of compatible Rh-negative whole blood.

The following day it was noted that the jaundice had increased in both babies and, more importantly, both had developed marked generalized edema. Baby B had gained 2 ounces and Baby A had gained 5 ounces. The legs, arms, and scalp were puffy and could readily be pitted. The edema and the jaundice gave the infants a waxy appearance. Baby B was again given a transfusion of 50 c.c. of whole blood, but transfusion was temporarily delayed on Baby A because of his initial high hemoglobin and red cell values. As the day progressed, Baby A became somewhat dyspneic and bubbling râles were heard in the lungs. He was again transfused, but despite the transfusions, and the use of continuous carbogen, he expired fifty-four hours after birth. At the time of death this infant manifested marked generalized edema, the arms and legs being approximately twice their initial circumference. There was marked pitting of the extremities, back and scalp.

On the morning of the third neonatal day, the surviving infant, Baby B, manifested a greater degree of jaundice and edema, though the blood count revealed a rise in hemoglobin to 14 Gm., a drop in white cells to 40,000, and a drop in normoblasts to 85 per 100 white cells. (Fig. 1 shows this and subsequent studies.) The child was again transfused, but the edema became more marked. He became dyspneic, and râles were heard. At this point the infant looked far more edematous than had his twin.

It was realized that transfusions were obviously of no value in combatting the edema, and it was decided to attempt to dehydrate the tissues by a transfusion of concentrated human serum albumin.* The infant was given 45 c.c. of the serum albumin, containing 11.25 Gm. of albumin. Within six hours a very pronounced diminution in the edema was noted. The veins of the extremities, previously not visible, could now be seen, and the pitting was slight.

The following morning the edema had recurred, though not to as marked a degree, and the infant had gained an additional 2 ounces. Another transfusion of 50 c.c. of whole blood was given and, there being no more available serum albumin at the moment, the child was given 20 c.c. of five times concentrated dried plasma. No appreciable effect could be noted following this therapy.

On the morning of the fifth day the edema was found to be still greater and on the order of that before the initial use of serum albumin. The child had gained 3 ounces. Twice that day and once again on the sixth day he was given 6.25 Gm. of the now avail-

*The human serum albumin was kindly furnished by Dr. Charles Janeway of the Boston Children's Hospital.

able human serum albumin. Although he continued to gain weight for several days more, the edema rapidly diminished so that by the seventh day it was barely perceptible and was totally gone by the ninth day. No pitting was demonstrable, and the extremities were not at all swollen. The liver was still enlarged, the spleen barely palpable. A supportive transfusion of whole blood was given on the eleventh day.

The infant showed a slowly diminishing residual jaundice. The liver and spleen were no longer palpable and there was no edema. There were no positive neurological findings. He was vigorous, had a lusty cry, and gained weight. Normoblasts were no longer present in the peripheral blood, the components of which were those of a completely normal newborn infant.

CASE 2.—M. K., a white male was born at 11:55 P.M. on Feb. 8, 1946, of an Rh-negative mother. The vernix and amniotic fluid were noted to be yellow at the time of delivery although the infant was not jaundiced. Within twelve hours, however, the child was markedly icteric and the liver and spleen were found to be enlarged. The peripheral blood revealed 82 nucleated red blood cells per 100 white blood cells, 16 Gm. hemoglobin, 3,660,000 red blood cells, and 49,000 leucocytes.

He was immediately given a transfusion of 65 c.c. of Rh-negative whole blood, and this procedure was repeated on the second day of life.

On the third day he had gained 3 ounces and there was periorbital edema as well as edema of the scalp, hands, legs, and feet. He was given a third transfusion, but despite a good hematological response, he continued to become more edematous.

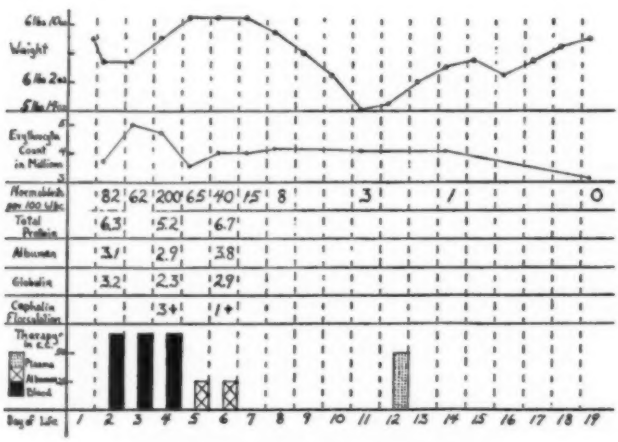


Fig. 2.—Course of infant M. K. (Case 2).

On the fourth day he had gained an additional 3 ounces and there was now a marked pitting edema of the entire body. At this time he was given 6.25 Gm. of concentrated human serum albumin intravenously. There resulted a marked diminution of the edema within six hours. As an index, it was noted that there was a one-half inch decrease in the circumference of the legs.

The next morning the edema had reappeared, but not to the extent of the previous day. The weight remained stationary. He was again given 6.25 Gm. of concentrated human serum albumin and by the following day there was no apparent edema. The eyes, which had previously been so puffy that the infant could not open them, were now wide and bright, and his jaundiced sclerae could be seen readily.

The child proceeded to make a completely uneventful recovery from his erythroblastosis. For a while he was a feeding problem, but this was only transitory. During

the fourth week of life he was given two supportive transfusions. At the time of writing he is alive and doing very well. His peripheral blood picture is entirely normal and he is completely negative on physical examination.

This patient was particularly interesting because we had the opportunity of doing various blood studies during the course of his disease. (Fig. 2.) It was noted that despite early transfusions there was a marked drop of 1.1 Gm. in the serum proteins. Along with this fall in the protein level the edema appeared and when this fall was corrected the edema disappeared. The positive cephalin flocculation test (3 plus) and a prolonged prothrombin time showed marked liver damage, and the fall in the flocculation was taken as an indication of the recuperative powers of the liver.

TABLE I. HEMATOLOGICAL COURSE OF INFANT "B"

| DAY OF LIFE | HEMOGLOBIN IN GRAMS | ERYTHROCYTES | LEUCOCYTES | NORMOBLASTS PER 100 WBC |
|---|---|---|---|---|
| 1 | | | | |
| 2 | 7.0 | 1,250,000 | 400,000 | 400 |
| 3 | | | | |
| 4 | 14.0 | 4,250,000 | 40,000 | 85 |
| 5 | 16.0 | 4,900,000 | 11,000 | 8 |
| 6 | 17.0 | 5,100,000 | 11,500 | 5 |
| 7 | 17.0 | 5,190,000 | 10,000 | 3 |
| 8 | 15.4 | 5,300,000 | 10,000 | 3 |
| 9 | 14.5 | 4,800,000 | 9,500 | 2 |
| 10 | | | | |
| 11 | 12.5 | 4,050,000 | 8,600 | 1 |
| 12 | 12.0 | 3,700,000 | 8,600 | 1 |
| 13 | 12.5 | 4,250,000 | 8,000 | 0 |
| 14 | 13.0 | 4,250,000 | 10,950 | 0 |
| 15 | | | | |
| 16 | 12.5 | 4,220,000 | 11,000 | 0 |
| 17 | | | | |
| 18 | 11.5 | 3,850,000 | 14,500 | 0 |
| 19 | | | | |
| 20 | 10.5 | 3,660,000 | 16,000 | 0 |
| 21 | 10.5 | 3,680,000 | 16,400 | 0 |
| 22 | 10.8 | 3,770,000 | 10,550 | 1 |
| 23 | 9.3 | 2,890,000 | 15,500 | 1 |
| 24 | | | | |
| 25 | 9.4 | 3,190,000 | 23,500 | 1 |

TABLE II. HEMATOLOGICAL COURSE OF INFANT "M. K."

| DAY OF LIFE | HEMOGLOBIN IN GRAMS | ERYTHROCYTES | LEUCOCYTES | NORMOBLASTS PER 100 WBC |
|---|---|---|---|---|
| 1 | | | | |
| 2 | 16.0 | 3,660,000 | 49,000 | 82 |
| 3 | 17.2 | 5,030,000 | 35,000 | 62 |
| 4 | 18.0 | 4,700,000 | 50,000 | 200 |
| 5 | 17.0 | 3,500,000 | 20,000 | 65 |
| 6 | 15.0 | 4,050,000 | 20,000 | 40 |
| 7 | 14.0 | 4,000,000 | 18,000 | 15 |
| 8 | 14.0 | 4,250,000 | 17,000 | 8 |
| 9 | | | | |
| 10 | | | | |
| 11 | 13.0 | 4,100,000 | 18,000 | 3 |
| 12 | | | | |
| 13 | | | | |
| 14 | 16.0 | 4,110,000 | 17,000 | 1 |
| 15 | | | | |
| 16 | | | | |
| 17 | | | | |
| 18 | | | | |
| 19 | 9.5 | 3,100,000 | 12,000 | 0 |

SUMMARY

Two cases of erythroblastosis fetalis complicated by severe generalized edema successfully treated with concentrated human serum albumin are reported. The first was one of twins, in which the untreated sibling died. In the second case, blood studies were done and it was found that the use of the serum albumin corrected an early fall in the blood protein level with subsequent elimination of the severe generalized edema.

It is postulated that liver damage, frequently a feature in severe erythroblastosis fetalis, with a disturbed blood protein level was the causative mechanism of the edema, and that the serum albumin restored the level. Studies are now in progress further to elucidate these factors.

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# DIAGNOSIS AND MANAGEMENT OF SEVERE INFECTIONS IN INFANTS AND CHILDREN: A REVIEW OF EXPERIENCES SINCE THE INTRODUCTION OF SULFONAMIDE THERAPY

## VI. Acute Iliac Lymphadenitis

Meri J. Carson, M.D., and Alexis F. Hartmann, M.D.
St. Louis, Mo.

WHEN acute inflammation of superficial lymph nodes occurs, accurate diagnosis can usually be readily established. When, however, the deeper lymph nodes are involved, diagnosis becomes more difficult, and a number of other important conditions must be considered.

The deep iliac lymph nodes are situated retroperitoneally, deep in the iliac fossae, lying adjacent to the external and common iliac vessels and anterior to the psoas muscles. Their afferent lymphatics drain the inguinal and subinguinal glands, the deep lymphatics of the abdominal wall, the adductor region of the thigh, the glans penis, urethra, prostate, fundus of the bladder, cervix uteri, and upper vagina. In the St. Louis Children's Hospital, the diagnosis of acute inflammation of the deep iliac lymph nodes has been made in eleven patients with confirmation by operation in six. An analysis of our cases follows.

The ages of the patients varied from 22 months to 12 years. There was an almost equal distribution between sexes, six males and five females. Most of the cases reported in the literature have likewise occurred in children, with also a nearly equal distribution between males and females.[4, 7, 8]

Upper respiratory infections immediately preceded the onset of illness in two instances, trauma to the lower abdomen and urinary tract infection each in two cases, palmar abscess with concomitant vaginitis once, and in four cases no definite history of any preceding infection or trauma could be elicited.

In the literature[2, 3, 4, 7, 9] the predisposing factors mentioned have been appendicitis; hematogenous spread from upper respiratory infection, impetigo, furunculosis, and pneumonia; trauma; intestinal diverticulitis; infection of lower extremities; perforating intestinal foreign body; gastroenteritis; miscarriage; puerperal infection following delivery; and infection in the posterior urethra, prostate, or rectum.

Fever was a constant finding in the reported cases. It was usually very high in cases with an acute onset, but low in cases developing more gradually. In ten of our cases, fever was noted before admission, varying in duration from one to thirty days. During the period of hospitalization, all the patients had fever, usually of a septic type with peaks from 38.6 to 41.6° C. Temperatures above 38° C. have persisted as long as sixty days.

Abdominal pain and/or pain in the hip region or thigh were present in all except one patient* for several days before the patient was first seen. Four

From the Department of Pediatrics, Washington University School of Medicine, and the St. Louis Children's Hospital.

*Signs of iliac adenitis developed in this patient only after the second hospital day.

patients complained of abdominal discomfort, which varied from a dull ache to a severe, intermittent, sharp, stabbing pain. In one case the abdominal pain was generalized for three days, with final localization in the right lower quadrant. The remaining seven patients had pain in the hip, thigh, or lower lumbar regions.

Constant or intermittent abdominal pain was also usually noted in the reported cases,[3, 4, 5, 7, 8, 9] and as in our experience, pain was also frequently noted in the hip region or occasionally referred down the thigh to the knee.[8]

Two of our patients had dysuria, one also presenting frequency. In none of our patients was any evidence of urinary tract infection found. Dysuria, pain at the end of micturition, and even reflex urinary retention have been reported by Coutts[3] who demonstrated transient hydronephrosis together with a temporary increase in blood urea due to ureteral compression by the enlarged glands. With cystoscopy in several cases he noted bulging of the bladder wall with a bullous edema nearest the site of the inflamed gland.

Nausea and vomiting were not prominent symptoms in our cases, reflecting the very slight degree of peritoneal irritation usually present. This was also true in the reported cases, a point of considerable importance in excluding acute appendicitis.

Psoas spasm was noted in eight of our eleven patients and was also one of the most characteristic findings in the reported ones.[5, 7, 9] The muscle spasm was always quite marked, so that the patient either could not walk at all or walked with a decided limp. Extension of the affected leg was always impossible, and the patients invariably preferred to lie in bed with the thigh adducted and flexed on the abdomen at all times. In contrast, however, there was no limitation of motion except for extension of the thigh. This point is extremely important in eliminating the diagnosis of hip joint disease.

Abdominal tenderness and rectus muscle spasm were present in ten of the eleven cases. The former varied slightly and was sometimes generalized but occasionally marked and localized over the lower abdomen and accompanied by marked muscle spasm. In five cases, palpable masses were present in either the right or left lower quadrants just above Poupart's ligament. These were very tender and firm. In the reported cases, abdominal masses had also usually been found.[4, 6, 7] It must be emphasized that the early cases will not have a palpable mass since this develops gradually as the glands enlarge or suppurate and, therefore, is to be expected only in the more chronic cases. Ladd and Gross[9] noted that approximately one-half of their cases went on to suppuration with abscess formation.

Occasionally the enlarged glands or abscesses have been palpated on rectal examination, although this was not true in any of our cases.

In every case there was a leukocytosis varying from 10,750 to 35,250 with a moderate shift to the left in the differential. Anemia was reported in cases of long standing.

Blood culture was positive for hemolytic *Staphylococcus aureus* in two of our cases and sterile in five others. Culture from iliac nodes or abscesses showed *Staph. aureus* in three cases and hemolytic streptococcus once.

Of the reported cases the most common organism isolated from blood, infected glands, or abscesses has been hemolytic *Staph. aureus* with the hemolytic streptococcus next in frequency.[1, 3, 4, 6, 7, 8] The pneumococcus has also been isolated,[7] and Coutts,[3] and Hyman[4] feel that *Bacillus coli* is occasionally responsible.

Operation was performed in six cases. Enlarged, chronically infected iliac glands without abscess were found twice. Extraperitoneal abscesses were found in five cases, once at a second operation when at first only enlarged lymph nodes were noted. Four of the abscesses were located in the iliac fossa, and the fifth was in the lower lateral abdominal wall with a tract leading downward into the iliac fossa. All six of the patients operated upon eventually recovered. Tuberculin tests were uniformly negative. Roentgenographic examinations of the bones of the pelvis, hip joint, and femur in seven of our patients revealed no bony changes. The other four patients were not examined by x-ray.

Three of our cases were treated conservatively without specific therapy. General supportive measures were used with drainage of the abscess as soon as definite localization occurred. Use of sulfonamide drugs alone in six instances failed to produce prompt clinical improvement. In the last two patients treated here, penicillin was used with very prompt subsidence of signs and symptoms. In both instances a hemolytic *Staph. aureus* bacteriemia was found to be present.

### SUMMARY OF TWO REPRESENTATIVE CASES

CASE 1.—I. G. A., an 8-year-old girl, had four chills three weeks before admission and continued to run a low-grade fever daily after that date. Malaise and weight loss were noted, and for one week a limp of the right leg, and pain in the right hip were present. Physical examination revealed a chronically ill girl, temperature, 38.6° C. There was a firm tender mass about the size of an egg just above Poupart's ligament in the right lower quadrant. The right thigh was held adducted and flexed on the abdomen. Attempted extension of the right leg and thigh caused severe pain. Laboratory findings: white blood cells, 18,200 with a moderate shift to the left; hemoglobin, 85 per cent; red blood cells, 3.5 million; urine negative; tuberculin negative. X-rays of both hips and pelvis showed no bone changes. No specific therapy was given; the temperature remained elevated, and the white blood count rose to 31,600. On the seventh day, a laparotomy was performed, revealing enlarged retroperitoneal iliac nodes which on examination showed evidence of chronic infection. Following operation, the temperature reached 39.6° C. with wide daily fluctuations. Abdominal pain, tenderness, and right psoas spasm persisted. On the fifteenth postoperative day the wound broke open, evacuating a large amount of pus which on culture revealed hemolytic streptococci. The temperature then rapidly dropped to normal, and the patient was discharged on the thirty-third day.

CASE 2.—R. E. B., 7-year-old white boy, entered the hospital, complaining of fever, malaise, and sharp pains in the left thigh of four days' duration. Before admission the pain shifted to the left hip and flank, and nausea and vomiting developed. For three days before admission there was dysuria and frequency. Physical examination: Temperature, 38.8° C. The patient was acutely ill with marked tenderness in the left lower quadrant and left inguinal region. The left thigh was rigidly flexed on the abdomen and could not be extended. The left hip joint could easily be moved through all its motions without pain, except for extension which caused severe pain. Laboratory findings: white blood cells, 16,750 with a moderate shift to the left; urine negative; blood culture, hemolytic *Staph. aureus*. X-rays of hip joints and femurs showed no bone changes. Tuberculin negative. He was placed on penicillin 10,000 units subcutaneously every two hours and

sulfadiazine. Sulfadiazine was discontinued on the fourth day, after the staphylococcus was reported present in the initial blood culture. There was a rapid improvement of both signs and symptoms; the temperature dropped to normal on the fourth day, and the patient was discharged on the tenth day much improved.

## DISCUSSION

The syndrome of iliac lymphadenitis usually presents a fairly definite picture. There may be a history of preceding infection or trauma with either an acute onset or one which is slowly progressive. Fever is always present. Pain is present either in the lower abdomen, thigh, hip region, or knee on the affected side. Usually there is psoas spasm with limping and flexion of the thigh on the abdomen. Tenderness and muscle spasm are usually present in the lower abdomen on the affected side. A mass may be present in the lower abdomen, especially in long-standing cases which may also show weight loss and anemia. Of particular importance is the fact that the hip joint on the affected side can be moved through all its motions, except extension, without pain. Occasionally urinary symptoms of dysuria and frequency may be noted. Signs of peritoneal irritation, namely nausea and vomiting, are usually absent.

Several conditions must be considered in the differential diagnosis.

*Osteomyelitis* of the femur or bones of the pelvis must be ruled out. Although pain in the thigh is a frequent complaint, tenderness on deep palpation of the femur and the palpable bones of the pelvis is absent. Localizing signs of redness, swelling, or increased heat over any portion of the thigh or hip are absent. Roentgenographic examination of the bones of the pelvis and thigh at no time reveals bone changes. Pyogenic osteomyelitis of the bodies of the lower lumbar vertebrae with direct extension of the infection into the psoas muscle may give signs and symptoms indistinguishable from those found in iliac adenitis. The differential diagnosis then may only be made when areas of destruction in the vertebrae are found by x-ray examination.

*Infection in the hip joint* can usually be ruled out by demonstrating free and painless motion of the joint. The only limitation of motion is that due to psoas muscle spasm with the thigh kept flexed on the abdomen in the position of adduction. Attempted extension is very painful, and the leg and thigh cannot be completely straightened. Roentgenographic examination shows no evidence of change in the hip joint.

*Rheumatic fever* may be differentiated occasionally by the history alone. The history of migrating polyarthritis is lacking, and the joints are never red and swollen. Rheumatic nodules and evidence of acute rheumatic carditis are lacking. The abdominal mass is not present, nor do patients with rheumatic fever adopt a postural attitude with persistent flexion of the thigh such as is seen with psoas spasm in iliac lymphadenitis.

*Appendicitis* may be hard to rule out if the involvement is on the right side. In iliac lymphadenitis signs of peritoneal irritation, nausea, and vomiting are usually absent, and examination reveals no rebound tenderness. The localized point of maximal abdominal tenderness is just above Poupart's ligament and below McBurney's point. Psoas spasm is usually more persistent and more

marked than that sometimes found in acute appendicitis. The temperature is frequently higher than one would expect to find with an early acute appendicitis. Occasionally iliac lymphadenitis is accompanied by enlargement and signs of infection in the corresponding inguinal and/or femoral glands. The initial complaint with acute appendicitis is usually abdominal pain, but with iliac lymphadenitis the initial pain is usually in the hip, thigh, or knee.

*Psoas abscess of tuberculous* origin is occasionally seen. Here, too, the typical picture of psoas spasm is seen, but in addition one finds physical and roentgenographic evidence of disease of the vertebral column and frequently of the lungs also. The tuberculin test is positive, and the onset of this disease is much slower and more insidious.

*Recommended Treatment.*—The plan of treatment should vary somewhat depending on whether or not an abscess is present. The early acute cases are seen when there is no suppuration of the iliac nodes. As *Staph. aureus* is the most common causative organism, we feel the drug of choice is penicillin given subcutaneously every two hours. For the average child, from 10,000 to 20,000 units at each injection should be sufficient. Since some cases might be due to *B. coli*[3] or other penicillin-resistent organisms, a sulfonamide should be given concomitantly in appropriate dosage. In all of the cases which we have treated with such a regime there was rapid and complete recovery without abscess formation.

The cases in which an abscess is present are usually those which have had a gradual onset. The symptoms have usually persisted for several weeks, and a mass has almost always been present in the lower abdomen when the patient was first seen. These patients should receive penicillin and sulfadiazine as outlined previously. In addition, however, surgical drainage of the abscess must be carried out after localization has occurred. This operation as described by Neuhof and Arnheim,[8] and Ladd and Gross[9] is not difficult or unduly dangerous when a careful extraperitoneal approach is used. They had no operative deaths in their cases, although the average operative mortality reported in the literature is approximately 5 per cent.[8]

## CONCLUSIONS

1. Iliac lymphadenitis is a not infrequent condition during childhood and must be differentiated from rheumatic fever, osteomyelitis, suppurative arthritis, appendicitis with or without abscess formation, and tuberculosis of the spine with psoas abscess.

2. The causative organism is usually the hemolytic *Staph. aureus*, although hemolytic streptococci and pneumococci have also been identified, and *B. coli* justifiably suspected.

3. The most characteristic features of the condition are fever and leucocytosis, pain in the abdomen, hip, thigh or knee, psoas spasm with protective flexion of the thigh on the abdomen, free motion of the hip joint except for extension of the thigh, and sometimes lower abdominal tenderness with a mass just above Poupart's ligament.

4. Early vigorous treatment with penicillin and sulfonamides may prevent abscess formation. In cases with an abscess present, extraperitoneal surgical drainage must also be employed.

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# THE TREATMENT OF SCABIES IN CHILDREN WITH A NEW SARCOPTICIDE

T. J. McElhenney, M.D.
Austin, Texas

THAT the incidence of scabies rises sharply during wartime is well appreciated. Scabies reached epidemic proportions in England during World War II and is apparently on the increase in the United States.[1] It is generally maintained that inadequate housing facilities, necessitating the overcrowding of living quarters, is an important factor in the spread of this parasitic skin infestation. One may therefore expect it to become even more widespread in our own country until the housing situation is bettered.

Of all the many sarcopticides recommended and used throughout medical history, not one has proved entirely satisfactory.[2] Sulfur preparations have undoubtedly enjoyed the widest usage. Although sulfur preparations have in general been satisfactory, they have had a number of disadvantages, such as objectionable odor and messiness, high percentage of untoward skin reactions, and necessity of efficient washing and scrubbing of the patient before treatment.

Recently the use of benzyl benzoate against the Sarcoptes has become popular in the United States. The benzyl benzoate treatment is by no means new, as this drug is the main active ingredient of balsam of Peru, which has been used for many years.[3] Apparently Sachs and Juliusberg[4] in 1900, first advocated benzoate itself as a sarcopticide; however, it was not until 1937, that Kissmeyer[5] popularized the medicament. During the recent war this drug was widely used in the epidemic in Great Britain; and British dermatologists now seem to believe that it is superior to sulfur in deadliness and speed of action against the itch mite.

Apparently benzyl benzoate may not be used indiscriminately. Intractable scrotal dermatitis has been known to occur after its use,[6] and Daughtry[2] has recently described several cases of severe skin reactions attributable to it. Furthermore, benzyl benzoate is not well-suited to therapy in infants and small children, as its application always causes a certain amount of stinging, and when applied to raw areas may be extremely painful.[6] In his own practice the writer has hitherto tended toward the use of sulfur formulas in the treatment of scabies, but has never prescribed the vigorous washing and scrubbing of small children.

Recently the writer has had the opportunity to treat twenty-two cases with a new sarcopticide, an ointment containing Zyclophen.* The results to date, it is felt, warrant bringing this new formula to the attention of pediatricians. This

*Zyclophen is the name given by the U. S. Standard Products Company of Woodworth, Wis., to a mixture of equal parts by weight of 4-chloro-3, 5-dimethylphenyl hydrogen *di*-camphorate and *ortho*-phenylphenol.

ointment is an invention of Dr. Max N. Huffman of the Southwestern Medical Foundation, and it is composed of the following ingredients:

| | |
|---|---|
| 4-Chloro-3,5-dimethylphenyl hydrogen *dl*-camphorate | 1.0 Gm. |
| *ortho*-Phenylphenol | 1.0 Gm. |
| Anhydrous lanolin | 4.0 Gm. |
| White petrolatum | 94.0 Gm. |

A one-half ounce jar of this ointment was given to the parents of the infected child with the instruction to use only on affected parts twice daily (morning and night) for two successive days. No directions were given for unusual or extra bathing of the patient.

### CASE REPORTS

CASE 1.—C. F., a girl, 6 years of age, had a scabietic infection of 4 months' duration. She had previously been under the care of a physician who had used a sulfur-foam preparation without benefit. When first seen her condition was that of typical scabies with secondary involvement. In addition to pustules on the hands and about the body, she had the typical ring around the waist. Her parents spoke of her not being able to sleep because of intense itching. She cleared completely after the two-day treatment with zyclophen ointment.

CASE 2.—L. F., 6 years old, was the daughter of a war worker who had been engaged in war work in St. Louis, Dallas, New Orleans, and Houston. The child had been under treatment for scabies in each city but the infection had recurred each time. In Austin she presented typical scabies with rather considerable secondary involvement. Treatment as described resulted in complete cure. There has been no recurrence within two months.

CASES 3 AND 4.—Two boys, B. P. and J. P., presented similar pictures. They had each been treated with a sulfur-foam preparation but had each suffered a further outbreak of *Sarcoptes* activity. With these boys zyclophen was highly effective.

CASES 5 TO 22.—These eighteen cases represented an outbreak of scabies in one of the local schools. The group was about evenly divided according to sex and presented no unusual features. Each child was given the two-day treatment. Cure was complete in every case as evidenced by subsequent examination.

### COMMENT

All twenty-two patients, as is shown in the case reports, were cured after four applications of the ointment.

The writer definitely prefers zyclophen to any preparation he has used for the treatment of scabies in children. Management with it has been simplicity itself, and no skin reactions have been observed as yet. It is obvious, however, that not nearly enough cases have been treated to justify any statement regarding the sensitizing properties of the drug. The ointment has no odor and does not stain clothing; its application, so far, has not been painful to any child.

In one particular, zyclophen is markedly superior to the usual medicament employed against the itch mite, and that is in respect to its effectiveness in clearing up the secondary pustular involvement so often seen in scabies of long standing. This property is no doubt attributable to the fact that the drug is not only a sarcopticide but a bactericide and fungicide as well.

It is interesting to note that the percentage of active ingredient in the usual sarcopticide is relatively high. Thus, sulfur is ordinarily administered in 10

to 18 per cent strength, and benzyl benzoate in 20 to 25 per cent concentration. This item is of considerable importance, particularly in children, since the entire body (except for head and neck) is commonly covered with the preparation. In contrast, the concentration of active material in the zyclophen ointment was only 2 per cent;* this is surely to be regarded as a step in the right direction if it can be conclusively shown that this 2 per cent of drug is no more toxic nor irritative than a like concentration of one of the other parasiticides.

## SUMMARY

A series of twenty-two cases of scabies in children has been treated with a new parasiticide, zyclophen. Cure in each case has been rapid, complete, non-painful, and free from untoward reactions.

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* Dr. Huffman believes that the two active ingredients in zyclophen have a synergistic effect upon each other. (Personal communication.)

# STREPTOMYCIN IN PEDIATRICS

HATTIE E. ALEXANDER, M.D.
NEW YORK, N. Y.

SINCE the isolation of streptomycin by Waksman in 1943, a number of investigations on its in vitro and in vivo influence have suggested that this agent exerts its greatest antibacterial action against those organisms which have proved most resistant to penicillin, the gram-negative rods. The results are summarized in Table I. It is the aim of this report to analyze the published data and those of the authors in order to determine the value of in vitro sensitivity tests as an index of the therapeutic efficiency of streptomycin in infections caused by the organisms listed.

The in vitro sensitivities of a number of gram-negative rods expressed as MEC (minimal concentration of units per cubic centimeter of culture media necessary to prevent growth) are listed in two columns; in the first are those obtained from published reports and in the second are the values obtained at the Babies Hospital.

Analysis of the figures in column *I* suggests that this antibiotic will prove to be an effective therapeutic agent against infections caused by all of these organisms with the possible exception of about one-half of the infections caused by *Pseudomonas aeruginosa*. There are no published values for type b *Hemophilus influenzae*. Reports on a few strains of nontypable varieties indicate that these organisms are very sensitive to streptomycin. *Pasteurella tularensis* has exhibited a striking degree of sensitivity; the range of variation between strains has been narrow.

There are two values listed in column *I* for each of the group of four organisms which most frequently infect the urinary tract but which in young infants occasionally invade the blood and meninges. The first figure represents the MEC obtained for the majority of strains of each organism. The second figure shows that certain strains of three of the organisms of this group resist high concentrations; 50 per cent of the strains of pyocyaneus show this trait but the percentage is smaller for other organisms. The wide variation among different strains in this whole group has been confirmed by a number of investigators.

The values listed for *Eberthella typhosa* and Brucella strains suggest that both organisms are susceptible to concentrations easily obtained in biologic fluids by the dosage schedule commony used.

How do the in vitro sensitivities in column *I* correlate with therapeutic results in human infections? In tularemia the in vitro tests provide an accurate index of therapeutic effectiveness of streptomycin. The published ex-

From the Babies Hospital and Department of Pediatrics, Columbia University College of Physicians and Surgeons.

Presented before the Meeting of Region I, American Academy of Pediatrics, New York, N. Y., April 2-4, 1946.

TABLE I. CORRELATION BETWEEN IN VITRO SENSITIVITY AND THERAPEUTIC VALUE

| BACTERIAL AGENT | IN VITRO SENSITIVITY *MEC UNITS PER C.C. | | THERAPEUTIC VALUE |
|---|---|---|---|
| | PUBLISHED REPORTS | BABIES HOSPITAL | |
| | I | II | |
| *H. influenzae* | | 0.8 – 10.8 | + |
| *P. tularensis* (Tularemia) | 0.15 – 3 | | + |
| *E. coli* | < 8 – >256 | 13.3 – 25 | + |
| *A. aerogenes* | < 8 – >256 | 5 | + |
| Proteus | < 8 – 28 | 15 – 100 | + |
| *Ps. aeruginosa* (Pyocyaneus) | <40 – >256 | 100 – 200 | ± |
| *E. typhosa* | 6 – 18 | 25 – 75 | ? |
| Brucella | 0.1 – 0.5 | | ? |
| *S. paradysenteriae* | 1.4 – 7.5 | 25 | N.D.† |
| Salmonella | 3 – 28 | 25 – 200 | N.D.† |
| *K. pneumoniae* (Friedlanders) | 0.15 – 2.5 | 1.6 | N.D.† |
| *H. pertussis* | | 3 – 5 | N.D.† |

*MEC—Minimal effective concentration.
†N.D.—Not determined.

perience with streptomycin therapy in tularemia is liimted to seven patients but the results were so striking, in degree and rapidity of improvement as well as in consistency of response, that one is led to believe that streptomycin will prove to be the most efficacious form of treatment yet applied to this disease.

Infections of the urinary tract constitute the largest group of infections in which the therapeutic value of streptomycin has been investigated. Most of these patients were members in the Armed Forces and developed urinary tract infections following injury to the spinal cord. The results in this group have not yet been published. However, verbal reports justify the conclusion that streptomycin represents an important contribution to therapy of urinary tract infections. On the other hand, the appearance of resistant strains during treatment has proved to be a significant problem. The civilian published experience is quite limited but is in agreement with this view. Herrelle has reported the largest series. Striking clinical improvement of the patients is reported but persistence or recurrence of infection and the emergence of resistance of the organisms have occurred fairly frequently. Nonetheless, the statement of Helmholz that streptomycin is the most effective single agent for treating mixed infections of the urinary tract may prove to be true. The limitations should emphasize the need to administer large doses from the beginning of treatment and the advisability of avoiding a large intake of fluid which will result in diluted urine. Under the schedule of administration to be described, the concentration of streptomycin in the urine has been maintained regularly above 250 units per cubic centimeter and at times reaches 1000 units per cubic centimeter when the fluid intake is normal and the kidney function is good.

In typhoid fever and brucellosis the results of treatment with streptomycin have been very disappointing. Only about a dozen patients with

typhoid fever and six with brucellosis have been reported but it seems clear already that little can be expected from streptomycin in these diseases. From the published figures there is no correlation between the in vitro influence and the therapeutic value.

It must be emphasized that the MEC values taken from published data have been obtained by in vitro tests carried out under widely varying conditions so they cannot be used as a basis for comparing the in vitro sensitivities of these different varieties of organisms.

*Relation Between In Vitro Influence and Therapeutic Effect of Streptomycin in H. influenzae Meningitis.*—The influence of a number of variables was studied in an effort to standardize an in vitro test which might serve as an index of sensitivity range of a representative number of *H. influenzae* strains and also as a guide to therapeutic effectiveness of streptomycin in an individual patient with meningitis. Three principles were applied. The inoculum was large (3 to 1,700 million organisms), the medium was optimal (Levinthal broth and agar), and the incubation period adopted for the test was 48 hours. Cultures of *H. influenzae* in Levinthal broth and Levinthal agar after a 6-hour incubation period were compared as sources of organisms for the test. A 2 mm. platinum loopful from each of these sources was seeded on each of a series of Levinthal agar plates containing varying concentrations of streptomycin ranging from 0.5 to 10.8 units per cubic centimeter. After incubation for 48 hours the lowest concentration of streptomycin which completely inhibited growth was defined as the minimal effective concentration or MEC of the strain. Fifty strains of type b *H. influenzae* have been studied by this method; all were found to be completely inhibited by concentrations between 0.8 and 10.8 units per cubic centimeter. Only three of these strains resisted concentrations beyond 7.5 units per cubic centimeter. A few cultures of types a, c, d, e, and f *H. influenzae,* as well as several strains of nontypable *H. influnezae,* have exhibited a comparable degree of sensitivity. Twenty-five of the type b strains were isolated from patients with influenzal meningitis prior to their streptomycin treatment; their range of sensitivity was between 0.8 and 7.5 units per cubic centimeter.

The strains isolated from two patients after the start of streptomycin treatment exhibited capacity to thrive in the presence of streptomycin in a concentration of 1,000 units per cubic centimeter. All of the sixteen sensitive strains studied exhibited increased resistance to streptomycin after a few subcultures in media containing streptomycin. Most of them grew in the presence of 525 units per cubic centimeter within a period of two weeks. Thus we were provided with a group of strains which were resistant to high concentrations of the antibiotic according to in vitro tests. Mouse protection tests were carried out to compare the in vivo sensitivity of the two groups: those showing sensitivity and those exhibiting resistance in vitro. The smallest single dose of streptomycin per mouse, which was sufficient to protect 50 per cent of the mice receiving 20,000,000 organisms each, or 1 million MLD (minimal lethal dose), was determined for both the sensitive and resistant

strains. A high degree of correlation was demonstrated between the MEC in vitro and the MED or minimal effective dose in mice.

Despite the agreement between the in vitro and in vivo tests neither method enabled us to select in advance the patients whose strains became resistant after the beginning of streptomycin treatment. Our therapeutic results suggest that it is the severity of infection and presumably the size of the bacterial population which determine whether the strain from a given patient will become resistant. This experience confirms the view held by most authorities in this field; any sensitive strain, if the population is large enough, contains a very small fraction of organisms which possess initially the capacity to thrive in the presence of any of its effective antibacterial agents (sulfonamides, penicillin, gramicidin). The apparent development of resistance appears to represent a selective process which eliminates the sensitive organisms and therefore permits the emergence of resistant members.

While these procedures fail to detect traits of resistance in the original strains, their use in determining the sensitivity of organisms cultivated from patients after the start of streptomycin treatment has provided a clear indication of the effectiveness of this antibiotic in the patients from whom the strains were isolated. In the group of patients in whom streptomycin treatment proved successful all strains isolated from spinal fluid or respiratory tract after the beginning of the treatment were shown to be sensitive. On the other hand, treatment was unsuccessful in two patients whose strains exhibited marked resistance during streptomycin administration. In one of these the organism isolated from the nasopharynx proved to be just as resistant as the strain grown from the spinal fluid.

The results of treatment of the twenty-five patients with type b *H. influenzae* meningitis who received streptomycin alone or in conjunction with other agents are summarized in Table II. Each patient is classified according to the severity of his infection and the therapeutic agent or agents used. Severity of infection was judged by two standards, clinical signs and the concentration of sugar in the original spinal fluid. In the cases of mild or average severity the level was above 30 mg. per cent in all but one patient whose

TABLE II. SUMMARY OF TREATMENT OF 25 PATIENTS WITH TYPE B H. INFLUENZAE MENINGITIS

| NUMBER PATIENTS TREATED | SEVERITY OF INFECTION | S.M. ALONE | | | SERUM AFTER 4 DAYS OF S.M. | | | S.M. AFTER UNSUCCESSFUL SERUM AND SULFADIAZINE | | | S.M. SERUM AND SULFADIAZINE INITIALLY | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R | S | D | R | S | D | R | S | D | R | S | D |
| 13 | Mild-average | 12 | | | | | | 1 | | | | | |
| 8 | Severe chronic | | | 2 | | 2 | | 1 | 1 | 1 | 1 | | |
| 4 | Severe early | | | | 1 | | | | | | 3 | | |
| | | | | | TOTAL | | R | | S | | D | | |
| | | | | | | | 19 | | 3 | | 3 | | |

S.M., streptomycin.
R, recovered.
S, survived.
D, died.

value was 24. In the severe group, whether the infection was in chronic or early stage, the concentration of sugar in the spinal fluid before treatment with streptomycin was 15 mg. per cent or below. The patients are divided into four groups according to the therapy received: streptomycin alone; streptomycin alone for four days after which time type-specific antiserum and sulfadiazine were added; streptomycin after unsuccessful treatment with type-specific antiserum and sulfadiazine; and those treated with all three agents initially. The results of treatment are recorded under *R* for complete recovery, *S* for those who survived but who exhibited serious cerebral injury, and *D* for those who died. All of these twenty-five patients, with one exception, had received sulfadiazine at home or in other hospitals before institution of streptomycin therapy. It can be seen that when the infection is of mild or average severity streptomycin alone brings about complete recovery. While, on the whole, clinical improvement was less rapid than that seen following serum treatment, the changes in the spinal fluid indicating clearing of infection appeared just as promptly as those seen following serum therapy. In nine of the twelve patients who recovered, the spinal fluid cultures proved sterile 24 hours after initiation of streptomycin therapy; in the other three, after 48 hours. The return to normal of the chemical constituents of the spinal fluid was equally rapid. When the disease is severe and other therapeutic agents are not used to supplement streptomycin until after four days or longer the results are very disappointing. In two of the five patients with severe forms of the disease, treated with streptomycin alone for four days or longer, the failure of the antibiotic to eradicate the infection was due to emergence of resistance of the infecting strains. The strains isolated from the spinal fluid after start of streptomycin exhibited the capacity to grow in the presence of 1,000 units per cubic centimeter. In the group of patients with severe infections, the disappointing results of treatment with the two forms of therapy, used separately have led us to adopt the policy of administering all three agents initially: streptomycin, type-specific antiserum, and sulfadiazine. Four patients with severe infections have been treated according to this plan and appear to have recovered completely.

Thus it is seen that the results of in vitro sensitivity tests do provide an index of therapeutic effectiveness of streptomycin in influenzal meningitis.

*Application to Other Gram-Negative Rods of Methods Used to Study in Vitro Sensitivity of H. influenzae.*—The in vitro method used for testing *H. influenzae* sensitivity was applied to a number of other gram-negative organisms. The results are listed in the second column of in vitro sensitivity in Table I. All strains were either recently isolated or had been preserved by drying and sealing under vacuum shortly after cultivation from patients. It is of interest that with the exception of *Escherichia coli, Klebsiella pneumoniae, Aerobacter aerogenes* (organisms against which sulfonamides are effective) and *Hemophilus pertussis,* the MEC and the range of sensitivities are significantly greater than those found for *H. influenzae.* Only a much greater clinical experience with streptomycin therapy in these infections can determine whether

the in vitro test, which has provided a good index of therapeutic effectiveness of streptomycin in influenzal meningitis, will also serve as an indication of its value in other infections. At least it permits an in vitro comparison of the influence of this agent on many gram-negative organisms. From the clinical data available the results of the in vitro method described are in better agreement than those obtained by methods already published. The growth of very few colonies in the higher concentrations, thus resulting in a high MEC, is in line with the frequency of recrudescence of infection, and demonstration of resistance of surviving strains.

*Schedule of Therapy Used in Patients With Influenzal Meningitis.*—The twenty-five patients presented were treated according to the following schedule: an amount of streptomycin solution containing 20,000 units per pound of body weight was introduced by the intramuscular route daily. This was given in eight doses at 3 hour intervals in a concentration of 50,000 units, or less, per cubic centimeter or by a continuous intramuscular drip in a total volume of 240 c.c. of physiologic saline. The drug was also administered intrathecally to all patients; the injections, usually one a day, varied in total number depending upon the response of the patient, and the dose was between 25,000 and 50,000 units depending upon the severity of the infection. Table III shows the variations in concentration of streptomycin in blood and spinal fluid in eleven patients.

On this dosage there were no toxic manifestations which persisted after withdrawal of the drug. The duration of treatment was only five days for most patients. This period appears to be adequate for all patients with meningitis. The occurrence of eighth nerve deafness in a significant number of pa-

TABLE III. CONCENTRATION OF STREPTOMYCIN IN BLOOD AND SPINAL FLUID IN INDIVIDUAL CASES OF H. INFLUENZAE MENINGITIS, CORRELATED WITH DOSE OF STREPTOMYCIN ADMINISTERED AND SUSCEPTIBILITY OF INFECTING ORGANISM

| CASE | STREPTOMYCIN CONCENTRATIONS (UNITS PER C.C.) BLOOD[1] | SPINAL FLUID[2] | STREPTOMYCIN DOSE AND ROUTE (UNITS × 1000 EVERY 24 HRS.) IM[3] | | | IT[4] | MEC[5] UNITS PER C.C. |
|---|---|---|---|---|---|---|---|
| 1. | 8.9 – 30.6 | 9.1 – 20.4 | C.D. | 20 | per lb. | 50 | 2.7 |
| 2. | 5.1 – 10.1 | -- -- | q3h | 20 | per lb. | 25 | 2.6 |
| 3. | 4.2 – 8.5 | 11.5 – 5.1 | q3h | 20 | per lb. | 25 | 4.9 |
| 4. | 10.1 – 19.1 | 11.8 – 20.0 | q3h | 20 | per lb. | 25 | 1.6 |
| 5. | 6.2 – 14.6 | 6.2 – 6.0 | q3h | 20 | per lb. | 50 | 2.8 |
| 6. | 5.5 – 14.5 | 5.0 – 28.0 | q3h | 20 | per lb. | 25 | 2.8 |
| 7. | 3.3 – 6.5 | 8.5 | q3h | 20 | per lb. | 25 | 4.4 |
| 8. | 7.3 – 22.0 | 4.9 – 16.3 | q3h | 20 | per lb. | 30 | 7.5 |
| 10. | 5.8 – 12.2 | 5.1 – 12.1 | C.D. | 20 | per lb. | 50 | 2.5 |
| 11. | 9.3 – 10.5 | 9.3 – 9.6 | q3h | 20 | per lb. | 25 | 1.6 |
| 12. | 7.5 – 9.8 | 11.1 | q3h | 20 | per lb. | 25 | 4.4 |

[1]Specimen collected daily at irregular intervals when intramuscular dose was given by continuous intramuscular drip (C.D.). When streptomycin was given every 3 hours (q3h) the blood was withdrawn 3 hours after the last dose.

[2]Spinal fluid concentrations represent those found 24 hours after intrathecal dose listed.

[3]IM, intramuscular.

[4]IT, intrathecal.

[5]MEC, minimal effective concentration of streptomycin necessary to completely prevent growth on Levinthal agar in 48 hours.

tients treated for periods longer than one week makes it a serious responsibility to determine and use the shortest period of treatment which is effective.

*Indications for the use of Streptomycin in Pediatrics.*—Analysis of the available facts justifies the following tentative statements. Streptomycin is indicated in the following infections:

A. Streptomycin alone
   1. Any type of *H. influenzae* meningitis of mild or average severity
   2. Tularemia
   3. Infections of urinary tract, blood, or meninges with Proteus or Pseudomonas groups
   4. Severe cases of typhoid fever and brucellosis
   5. Urinary tract infections with colon and aerobacter groups after failure with sulfonamides

B. Streptomycin plus sulfadiazine
   1. Infections of the blood or meninges with any member of the gram-negative rod group which originates from the intestinal tract
   2. Severe *H. influenzae* meningitis of types other than b

C. Streptomycin, sulfadiazine, and rabbit antiserum
   1. Severe type b *H. influenzae meningitis*

D. There is reason to believe that streptomycin will prove to be an effective agent against bacillary dysentery, some of the salmonella types, *K. pneumoniae,* and *H. pertussis infections,* but clinical trial is inadequate for evaluation.

## SUMMARY

Analysis of the published data shows lack of agreement between in vitro sensitivities and the clinical response to streptomycin of a number of human infections. Employment of an in vitro method which applied certain principles—use of a large inoculum (3 to 1,700 million organisms), an optimal medium (Levinthal broth or agar), and incubation period of 48 hours—yields sensitivities which are in better agreement with the available therapeutic results. Such statements must be accepted as only tentative until adequate clinical experience makes a final appraisal possible. The method offers a basis for comparison of all gram-negative rods studied. The test has provided a reliable index of the therapeutic efficacy of streptomycin in influenzal meningitis in which clinical trial does permit certain conclusions. The narrow range of sensitivity of all strains of *H. influenzae* studied prior to exposure to streptomycin is in agreement with the prompt recovery of patients who have meningitis of mild or average severity. On the other hand, in the severe cases therapeutic results with streptomycin alone have been disappointing; in two of the five unsuccessful cases the failures were due to emergence of resistance of the strains.

It is already clear that the therapeutic efficacy of streptomycin against most varieties of susceptible severe infections will be significantly influenced by emergence of resistance of the organisms.

# SALMONELLA ANATUM INFECTION

PHILIP J. ALMADEN, M.D., AND JOEL WAHLIN, PH.D.
LITTLE ROCK, ARK.

*SALMONELLA ANATUM* was first described by Rettger and Scoville[1] in 1920, having been isolated from diseased ducklings. Since that time, it has been found to be widely distributed among fowls and animals.[2] Its presence in the lymph glands of normal hogs has been reported by Hormaeche and Salsamendi,[3] and by Rubin, Scherago, and Weaver.[4] Cherry, Scherago and Weaver,[5] in a study of retail meat products, isolated *S. anatum* from hog liver. Varela[6] records the isolation of *S. anatum* from chickens, cattle, and hogs. It was in 1934, that Kauffmann and Silberstein[7] reported for the first time the occurrence of *S. anatum* in human infection. This observation has subsequently been confirmed by various investigators. Edwards and Bruner[2] in a study of 3,090 Salmonella cultures derived from various sources encountered *S. anatum* as a human invader twelve times as follows: fecal carriers, 4; feces in gastroenteritis, 7; and in blood culture once. Their observations cover the period of 1934 to 1941. Bornstein,[8] in his paper on the Salmonella problem, classifies 500 cases of salmonellosis from North America and Cuba during the period of 1939 to 1941. *S. anatum* occurred 13 times as follows: carriers, 3; gastroenteritis, 7; and no data, 3. After eliminating *S. paratyphi* A and *S. paratyphi* B from consideration, *S. anatum* constituted 3 per cent of the remaining types, a figure identical with its frequency of occurrence in both Connecticut and the Lexington Salmonella Center as tabulated by Bornstein. Previously Bornstein and associates[9] had encountered *S. anatum* twice. No details were given. Galton and associates,[10, 11] in Florida, encountered *S. anatum* in 13 instances during 1942 and 1943. Three were from cases, 9 from normal persons, and one with history unknown. Seligmann, Saphra, and Wassermann[12] record the isolation of 27 cultures of *S. anatum* from 26 outbreaks. Fourteen of these were from cases of gastroenteritis; one from a case of choleocystitis; one from a case of cerebrospinal meningitis; 8 from healthy carriers; and 3 without clinical data. Stools were positive in 26 instances and the spinal fluid was positive once. Two fatalities were reported. Rubenstein, Feemster, and Smith[13] list ten isolations of *S. anatum* in Massachusetts during the period 1937 to 1943 of which 7 were sporadic, and one subclinical, and 2 release cases. The presence of *S. anatum* in food handlers is reported by Stone.[14] Varela[6] reports the isolation of the organism from children and adults in Montevideo and Mexico. Kauffmann,[15] in a survey of Salmonella infections, mentions eleven outbreaks of *S. anatum* enteritis in Norway due to cheese. He tabulates a total of 34 strains from 28 persons with 3 deaths in the series. With the excepiton of Denmark, *S. anatum* infections in other European countries are not mentioned. On the other hand, Kauffmann notes that this species has been reported from Java a number of

From the Department of Bacteriology, University of Arkansas School of Medicine. Research paper No. 587, Journal Series.

times. From this it would seem that *S. anatum* is probably world-wide in distribution.

This report covers eight cases of *S. anatum* infection. Three of the eight cases occurred in March, 1944. There was no evidence of enteritis and the finding of the organism was incidental.

The organism was recovered first from a 9-month-old Negro female who was admitted to the hospital on March 2, 1944, for treatment of empyema. A culture of the pleural fluid obtained on March 4, was positive for pneumococci. On March 16, a second culture of the pleural fluid yielded both pneumococci and *S. anatum*. A single stool specimen was negative on culture. The case terminated fatally on April 8, 1944.

On March 9, 1944, a 2-year-old white male was admitted acutely ill with bilateral pneumonia. Abdominal distention was marked during the first five days of the patient's stay in the hospital. A stool culture taken on the fourth day for exclusion of typhoid fever yielded *S. anatum*.

A 4-year-old white female was admitted to the hospital on March 21, 1944, with a provisional diagnosis of bronchopneumonia and arthritis of eight days' duration. At time of admission the child appeared to be acutely ill. Her rectal temperature was 104.8° F., the pulse rate was 120, and the respiratory rate was 50. Marked cyanosis was present. There was localized tenderness over the trochanter of the left femur. The patient was placed in an oxygen tent, and given sulfadiazine and general supportive treatment. Blood cultures taken on the third and seventh days showed staphylococci. A stool culture taken on the seventh day yielded *S. anatum*. No evidence of diarrhea was noted. Further study of the case established a diagnosis of osteomyelitis and the patient was discharged in an improved condition on March 25, 1944.

In two of the above cases *S. anatum* was present in the stool apart from any evidence of gastrointestinal disturbance. This at least suggests the possibility that the patients were carriers of the organism.

An institutional outbreak of enteritis due to *S. anatum* occurred in the isolation wards during February and March, 1945, following the introduction of an initial case from the obstetric nursery. After the appearance of the second case, a survey of all involved personnel was made to ascertain whether or not a fecal carrier was the source. Cultures of stool specimens obtained from the attendants were negative for intestinal pathogens. Manual transfer of the organism from the initial case during routine care appeared to be the probable mode of transmission.

The case reports present clinical pictures of enteritis of a mild nature characterized by an abrupt onset, liquid green stools containing blood and mucus, and a relatively short duration. Prompt attention to the condition may have been responsible for the relatively mild nature of the disease.

CASE 1.—D. F., a newborn white female, was delivered spontaneously in the hospital on Feb. 17, 1945. She weighed 7 pounds, 2 ounces at birth. The infant was admitted to the nursery in apparently good condition and was started on breast feedings. On February 19, she weighed 6 pounds, 11 ounces. At this time she expelled several yellowish green stools that contained mucus. The rectal temperature was 98.8° F. On the following day five stools

were noted during an 8-hour period. The stools were liquid, green, and contained blood and mucus. The rectal temperature was 99.2° F. Oral feedings were discontinued and the infant was given 2½ per cent glucose in Hartmann's solution subcutaneously, one-half dram of kaopectate three times a day, and sulfadiazine orally. Bacteriologic examination of the stool revealed *S. anatum*. On the third day the diarrhea had subsided. One liquid green stool was noted. The rectal temperature was normal. The sulfadiazine, kaopectate, and parenteral fluids were continued and the infant was started on boiled skimmed milk and given water ad lib. No change in the treatment was made on the fourth day. The infant was greatly improved and spent a quiet night. The maximum rectal temperature was 99.6° F. On the fifth day the rectal temperature was normal. Parenteral administration of fluids was discontinued. The infant spent a quiet night and appeared to have recovered on the following morning. During the next 48 hours the temperature and bowel movements were normal.

CASE 2.—A. K. P., a 21-month-old white female child, was admitted to the hospital for treatment of tracheobronchitis, duration five days. On admission the child had a rectal temperature of 100.2° F., a respiratory rate of 30 per minute, and a pulse rate of 140 per minute. Stridor was present. The pharynx was inflamed but no membrane was noted. Smears and cultures of nose and throat were negative for diphtheria. The hemogram revealed no abnormality. Therapy consisted of steam inhalation, sulfadiazine, and general supportive treatment. The temperature varied from 99° to 103.8° F. during the first two days, but returned to normal the third day. Respiratory stridor disappeared about this time. On the fourth day the temperature ranged from 101.8° to 102° F. The child expelled three yellow liquid stools during an 8-hour period. Since it was believed that the respiratory infection was responsible, the patient was given 10,000 units of penicillin intramuscularly every three hours for a total dosage of 50,000 units. The next day the patient refused food. The temperature varied from 100° to 102° F. Three liquid stools containing a small amount of blood and mucus were noted. Culture of the stool yielded *S. anatum*. Oral feedings were discontinued for 24 hours and 5 per cent glucose in normal saline was given subcutaneously. The sulfadiazine was discontinued and the temperature ranged from 102° to 105.4° F. One soft stool was noted during 24 hours. On March 3, the child appeared to have recovered and rested quietly. She accepted liquid feedings and had no diarrhea. The rectal temperature was 99° to 99.4° F. A soft diet was given thereafter and the remainder of the hospital stay was uneventful.

CASE 3.—W. D. H., a 5-month-old white male, was admitted to the hospital on Feb. 24, 1945, for treatment of bilateral conjunctivitis and upper respiratory infection of one week's duration. At the time of admission the rectal temperature was 100° F. The respiratory rate was 20 per minute and the pulse rate 116 per minute. Microscopic examination of the exudate from the eyes revealed Gram-negative diplococci of morphology characteristic of gonococci. No abnormality was noted on examination of the blood or urine. The rectal temperature varied from 100.6° to 99.6° F. during the first three days of the infant's stay in the hospital. On the fourth day all evidence of conjunctivitis had disappeared. The infant was afebrile and accepted his food. Early on the morning of the fifth day the infant passed two large green stools that contained blood and mucus. During the remainder of the day numerous small liquid stools were evacuated. The rectal temperature became elevated to 100° F. Oral feeding was discontinued for 24 hours and 5 per cent glucose in saline was administered subcutaneously. The specimen of feces yielded *S. anatum*. During the next day the baby expelled five brown semisolid stools. Boiled skimmed milk was given and subcutaneous fluids were discontinued. The maximum rectal temperature was 99.8° F. The boiled skimmed milk was given on the following day, during which time the temperature was normal. The patient was returned to a regular diet on the eighth day and appeared to be normal during the remainder of the hospital stay.

CASE 4.—J. K., a 7-month-old Negro male infant, was admitted to the hospital for treatment of bronchopneumonia, duration six days. At the time of admission on March 1, 1945, the rectal temperature was 104.6° F., the pulse rate was 200, and the respiratory

rate 56. The throat was slightly injected. Respiration was predominantly abdominal, the breath sounds were accentuated in the base of the left lung and were accompanied by a slight friction rub. The infant breathed in a gasping manner. Urinalysis revealed normal findings. The hemoglobin was 9 Gm. per cent, and red cell count was 4,940,000, the white blood cell count was 23,500. Therapy consisted of oral administration of sulfadiazine and general supportive measures. The patient's general condition appeared to improve rapidly. On the fifth and sixth days the infant rested and ate well and had no abnormal temperature. However on the seventh day the rectal temperature reached a maximum of 102° F. and a minimum of 100° F. Five liquid yellow stools were expelled in 24 hours. Culture of the stool yielded *S. anatum*. The urinalysis revealed no abnormality. Two grams of sulfaguanidine were given as the initial dose and was followed by 1 Gm. every four hours. The diet was changed to boiled skimmed milk and supplementary vitamins. Physical examination of the chest revealed no abnormality. At least four liquid stools containing blood and mucus were noted on the eighth hospital day. The rectal temperature varied from 101° to 103.4° F. The infant appeared to be in good general condition with no signs of dehydration or acidosis. Two semisolid stools free of blood were noted on the following day. The temperature ranged from 101° to 103° F. The infant vomited a small amount of one feeding. On the tenth day the rectal temperature and the bowel movements were normal. The infant was returned to an evaporated milk diet. During the next 72 hours he appeared to be normal. The sulfaguanidine was discontinued on the twelfth day. The infant lost no weight during the hospital stay and was discharged on the thirteenth day.

CASE 5.—A 5-month-old Negro female was admitted to the hospital on March 1, 1945, for treatment of a transverse fracture of the femur of one month's duration. With exception of the fractured femur, physical examination revealed no abnormality. An x-ray examination of the long bones gave evidence of scurvy. Examination of the blood and urine revealed normal findings. The patient was placed in Bryant's extension, was given a normal diet for her age plus large doses of ascorbic acid and other supplementary vitamins. She pursued an uneventful course until March 7, when she passed three green liquid stools during a period of 24 hours. The stools contained mucus but no blood. Since the diarrhea was mild, the dietary regime was not altered. A stool culture yielded *S. anatum*. The rectal temperature was slightly elevated during a 4-hour period reaching a maximum of 100.4° F. On the following day the stools were normal in number but still liquid. The remainder of the hospital stay was uneventful.

## DISCUSSION

On the basis of clinical manifestation, salmonella infections tend to be in one of the following categories:

1. Paratyphoid fever
2. Septicemia
3. Gastroenteritis
4. Carrier state

Considering the genus as a whole there is considerable overlapping in the clinical manifestations produced by the various species. Except for the paratyphoid group, this overlapping is so irregular as to make any association between species and clinical type of disease appear fortuitous. Bornstein and Schwarz[16] noted that the salmonella belonging to groups B and C caused the more severe type of disease. Hormaeche and associates[17] have classified the clinical types of enteric fever in three groups: (1) the dysenteriform type characterized by colic, "low" localization, frequent passage of stools containing mucus, pus, and often blood, and usually a high fever; (2) the choleriform

type, characterized by profuse watery diarrhea, the stools not containing pus or blood; and (3) mixed type. Here the process starts as one type and subsequently changes to the other type. The cases of enteritis described in this paper resemble Hormaeche's dysenteriform type. Although blood and pus were found in the stools in the cases here described, the disease was mild in nature and response to treatment was fairly prompt.

It is of interest to note that in seven of the cases some type of respiratory disease occurred. Although the number of cases is too limited to warrant definite conclusions, the question naturally arises as to the role played by the respiratory infection in lowering resistance and thereby paving the way for salmonella infection.

Bornstein[18] mentioned that sulfaguanidine was effective in controlling some salmonella infections, but not all. In the present series it was found that sulfadiazine given for treatment of the respiratory infection did not prevent the development of enteritis.

*S. anatum* is a member of Group $E_1$ based on the determination of somatic antigens present in the cell. In its pathogenicity for man it is most frequently associated with gastroenteritis, more rarely occurring in septicemia, choleocystitis, and meningitis. Kauffmann cites three deaths in a series of 28 cases, a mortality rate of 10.7 per cent. This is probably exceptional.

From the literature covering *S. anatum* one reaches the conclusion that it is world-wide in distribution. Man is afforded the opportunity of acquiring the infection from diseased and perhaps healthy animals and fowls. Its presence in meat products suggests another possible source of infection as shown by Cherry, Scherago, and Weaver.[5] Another possible source of infection is human carriers[2, 8, 10, 11, 12, 14] especially if they are food handlers. In the present study the source of infection remains obscure. Hormaeche and associates[17] have isolated *S. anatum* from flies at irregular intervals. The mild weather at the time our cases occurred permitted the ingress of flies even in March. The fact that a flock of experimental ducklings was kept in the vicinity of the hospital at the time the cases occurred suggests that insect transmission may have occurred. The probability of a carrier among the food handlers at the hospital was not excluded entirely, since only one stool specimen from each attendant was cultured, with negative results. However, since the infection was limited to one ward, it seems more likely that the mode of transmission was from patient to patient and that only those of low resistance contracted the enteritis.

## SUMMARY

1. Although infection with *S. anatum* is relatively uncommon, eight cases were observed during a period of thirteen months.

2. The clinical picture presented by five cases was that of enteritis characterized by elevation of temperature, mild diarrhea, and the appearance of mucus and blood in the stools soon after the onset of symptoms.

3. The disease was of short duration.

The authors are indebted to Dr. P. R. Edwards of the National Salmonella Center, Lexington, Ky., for serologic identification of the species.

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# TREATMENT OF EPIDEMIC DIARRHEA OF THE NEWBORN

MARTIN J. GLYNN, M.D.
NEW YORK, N. Y.

THE term, "epidemic diarrhea of the newborn," refers to a disease occurring in newborn nurseries, characterized by the passage of frequent, watery stools, body dehydration, and varying toxicity, with a tendency to involve many infants simultaneously.

## ETIOLOGY

This disease has increasingly forced itself on the attention of the pediatrist in recent years. Despite its frequency and high mortality, the causative agent has escaped certain identification. The work of Light and Hodes[1] and of Buddingh and Dodd[2] indicates that a filtrable virus is responsible for some epidemics. In an occasional epidemic, pathogenic bacteria are cultured from the stools.

## EPIDEMIOLOGY

The epidemiology is still obscure. There is suggestive evidence that the causative agent is transmitted from infant to infant by way of nurses and doctors caring for them. Buddingh and Dodd demonstrated that, in one epidemic, the causative agent could be isolated from the mouths of apparently well nurses and doctors, indicating that carriers may be an important factor in the transmission of this disease.

## PROPHYLAXIS

Prophylaxis of epidemic diarrhea aims at minimizing exposure of well infants to sources of infection. The dramatic disappearance of secondary cases of diarrhea at The Cradle in Evanston[3] suggests that rigid precautions can prevent transfer of the causative agent by personnel in attendance and by equipment.

Two observations of Light and Hodes raise the hope that prophylaxis by biologic means may be discovered. These workers produced diarrhea in calves with filtrate of stools from epidemics in newborn infants. After recovery, these animals were immune to further inoculation. Second, Light and Hodes demonstrated that some infants, recovered from epidemic diarrhea, had protective factors in their serum.

The work of Buddingh and Dodd indicates it may be possible to detect carriers by oral swabs applied to the scarified cornea of a rabbit.

## TREATMENT

The treatment of epidemic diarrhea of the newborn has several objectives:

1. Direct attack on the causative agent

From the New York Hospital and the Department of Pediatrics, Cornell University Medical College.
Presented before the Pediatric Section, New York Academy of Medicine, April 12, 1945.

2. Relief of the diarrha, per se

3. Correction of the disturbances in physiology caused by diarrhea, especially dehydration, disturbances of acid-base equilibrium, and vasomotor collapse

4. Maintenance of metabolic needs until the patient is well enough to tolerate a normal diet

*Attacks on Causative Agent.*—At present no method is at hand for a direct attack on the causative agent of this disease. The presence of a virus in some epidemics may explain why sulfonamide therapy has not been impressive. This opinion is borne out by our own observation.

In the absence of specific therapy, reliance must be placed on symptomatic treatment. The following plan of therapy for a severe case of epidemic diarrhea of the newborn is not inflexible nor is it necessarily the most effective, but it has been successful in our experience.

*Relief of the Diarrhea.*—Checking the diarrhea itself is best achieved by giving the patient nothing by mouth. Starvation is continued until the infant stops passing stools for at least twelve hours, or longer if necessary. Usually the frequency of stools decreases markedly during the period of starvation. The duration of starvation is usually twenty-four to thirty-six hours, but occasionally longer.

The decision to begin feeding by mouth is of critical importance, and must be individualized in each case. One requirement is absence of stools for twelve or twenty-four hours. The more severe or prolonged the diarrhea was, the longer should be the period free from stools before resuming oral feeding. A second requirement is return of the blood serum carbon dioxide content to normal. A third is marked improvement in physical findings.

Sterile tap water is used for the initial feeding. It is offered at frequent intervals, in small and gradually increasing amounts: 5 or 10 c.c. at the first feeding, increased by 5 or 10 c.c. every two or three hours thereafter. The increments are continued until the amount offered equals 150 c.c. per kilogram for twenty-four hours. At this point, water is cautiously replaced by a formula. Skimmed lactic acid milk may be substituted for water in increments of 5 or 10 c.c. per feeding. The increments are continued until the amount offered equals 150 c.c. per kilogram per twenty-four hours which provides 60 calories per kilogram. From this point on, a milk of higher fat content, for example, half-skimmed lactic acid milk, is gradually substituted for skimmed lactic acid milk in quantity sufficient to raise the caloric intake by 10 calories per kilogram per day. This low fat formula is fortified by the gradual addition of carbohydrate until 120 calories per kilogram per day are provided. Meanwhile, the number of feedings is reduced to six daily. The formula is then gradually replaced by one which can be easily provided at home.

As a rule, there is no recurrence of diarrhea during this gradual return to a normal caloric intake. A few loose stools may be noted during the first two or three days after starting water by mouth.

*Replacement Therapy.*—The disturbances of physiology caused by the diarrhea include vasomotor collapse, dehydration, and acidosis. Anemia and low serum proteins are commonly observed. It is conceivable that other metabolic errors are present which elude detection in the present state of our knowledge.

Methods to correct the distorted physiology are directed chiefly at increasing blood volume, restoring renal function, and correcting dehydration. These methods may be called "replacement therapy." Replacement therapy is both quantitative and qualitative.

The total amount of parenteral fluid needed is estimated chiefly from physical findings. The well-known signs of dehydration appear when fluid loss approximates 8 to 12 per cent of the body weight (80 to 120 c.c. per kilogram). However, as much as 20 per cent of the body weight may be lost daily during a very severe diarrhea. To supply maintenance as well as replacement needs, 200 to 250 c.c. of total fluids per kilogram parenterally are usually sufficient in the first day or two of starvation. The clinical response is a useful guide here. One looks for gain in weight, resumption of urinary flow, and disappearance of signs of dehydration.

Guideposts to qualitative replacement therapy are provided by history, physical signs, and initial blood chemistries. If the blood serum carbon dioxide content is under 35 volumes per cent, sodium lactate solution may be desirable. It is prudent to use two parts of physiologic sodium chloride solution to one part of one-sixth molar sodium lactate to preserve the normal relationship of sodium and chloride ions and prevent alkalosis. Elevated serum chloride on admission suggests poor kidney function, due, in most instances, to poor renal blood flow. After the amount of sodium lactate and saline has been estimated, the remainder of the fluid is given as 5 or 10 per cent glucose. Serum proteins are generally regarded as a good index of dehydration but their concentration at times is normal on the initial determination, only to fall below normal (e.g., to 5 Gm. per 100 c.c. or less) after fluids are given. A normal concentration of serum proteins on admission may be misleading in two respects: (1) it may wrongly suggest that dehydration is slight, and (2) it may mask a real hypoproteinemia which appears when dehydration has been corrected. The hemoglobin and red cell count may be wrongly interpreted.

In concrete terms, replacement therapy may be initiated as follows: A specimen of blood is drawn for determination of carbon dioxide content, serum chlorides, and serum protein. Where a free flow of blood is obtained, urea nitrogen is measured.

If the patient is very dehydrated, a clysis of physiologic saline, 40 c.c. per kilogram, is started, and an infusion of 10 per cent glucose, 20 c.c. per kilogram, is given during or immediately after the saline clysis. If the patient is in collapse the infusion should be started first and followed promptly by a clysis. When the physical findings suggest severe acidosis, one-sixth molar sodium lactate solution may be used in place of part or all of the saline in the clysis.

The combined effect of the two treatments is an increase in blood volume, improvement in renal blood flow and renal function, and partial repair of the sodium and water deficit. Clinically, these effects are manifested by improvement in the state of consciousness, activity, color, and cry. The signs of dehydration regress somewhat. Soon after these initial treatments, a transfusion of whole blood or plasma, 20 c.c. per kilogram, is administered. At this point, replacement therapy is well under way.

*Maintenance Therapy.*—The transition from replacement therapy to maintenance therapy is a gradual event. As each measurable factor returns to normal, our future aim is to maintain it at normal. As the diarrhea improves, from 1 to 1.5 Gm. of sodium chloride in an isotonic solution are given per day, parenterally. The level of serum chloride aids in gauging the dosage. Plasma infusions are given to maintain the total serum protein at 5.5 to 6 Gm. per 100 c.c. Water is continued at the rate of 175 c.c. per kilogram for a day or two, and usually reduced thereafter to 150 c.c. Five per cent glucose solution constitutes the greater part of the fluid administered during maintenance.

The fluid requirements are given in four separate treatments per twenty-four hours, usually in the form of two clyses and two infusions. Plasma or whole blood transfusions are given in addition.

It is imperative that parenteral fluids be continued after starting water by mouth, first to maintain an adequate fluid intake during the slow increase in the oral feeding, and second to supply glucose. At this stage, after a prolonged diarrhea, collapse due to hypoglycemia is occasionally seen.

Amino acids in maintenance therapy theoretically should be valuable. When starvation is prolonged or diarrhea recurs, the patient may be treated with Amigen. A clysis of 5 per cent amigen and 5 per cent glucose is well tolerated twice daily. Two infusions of 5 per cent glucose, in addition to these clyses, will provide 45 calories per kilogram per day. If one of the 5 per cent glucose treatments is given in saline, it will provide 1 Gm. of sodium chloride for the newborn infant of average weight. It is well to recall Hartmann's warning[4] that poor peripheral circulation, or very low serum proteins, is a contraindication to the use of a hypertonic clysis such as 5 per cent amigen and glucose.

It is prudent to administer certain vitamins during starvation. If the diarrhea or the starvation is prolonged, vitamin K should be administered in some form. In very prolonged diarrhea it is probably well to repeat an injection of vitamin K according to the level of prothrombin. Bleeding because of hypoprothrombinemia has been demonstrated in diarrhea in young infants. Ascorbic acid 50 mg., thiamin chloride 3 mg., riboflavin 2 mg., and niacinamide 10 mg. may be given by infusion daily. Larger doses are used in prolonged diarrhea.

Occasionally an infant continues to have diarrhea in spite of starvation of four or more days' duration. In such a case, the prognosis is poor whether starvation is continued or feedings are started in spite of the diarrhea. Recent experience suggests that the outlook for these infants is improved when

amigen and glucose are administered parenterally to provide 45 or 50 calories per kilogram daily in place of or in addition to oral feedings. Why these intractable cases do not respond to starvation is not clear. Perhaps the natural body defenses have not destroyed the causative agent of the diarrhea.

Another obscure question is why such patients die despite the usual restoration of chlorides, protein, serum carbon dioxide, and hemoglobin to normal levels by therapy. This repeated observation suggests that the infant has a disturbance in physiology which we cannot now measure. Butler, McKhann, and Gamble[5] stated in 1933: "Parenteral therapy has a large, often dramatic, effectiveness. It must be admitted, however, that it is not always successful and it may be hoped that recognition of an additional pathologic process in the situation will eventually produce supplementary measures which will provide a more complete control of the severe stage of diarrheal disease." In the same article these authors demonstrated that infants in an advanced stage of diarrhea excreted intracellular fluid "to an extent much greater than can be accounted for by release of water due to destruction of protoplasm," and referred to the desirability of replacing intracellular materials including potassium. More recent laboratory observations indicate that loss of intracellular potassium results from water depletion from various causes.[6*]

## RESULTS

Between Jan. 1, 1940, and Dec. 31, 1944, ninety-one full-term infants under 4 weeks of age were treated by this method with twelve deaths, a mortality rate of 13 per cent. Of ninety-two premature infants similarly treated in the same period, there were eighteen deaths, a mortality rate of 17 per cent.

## SUMMARY

The treatment of epidemic diarrhea of the newborn is still symptomatic and consists of relief of the diarrhea by starvation; correction of dehydration, acidosis, vasomotor collapse, anemia, and hypoproteinemia by parenteral fluids; maintenance of metabolic needs until the patient can tolerate a normal diet by mouth; and a very gradual resumption of a normal caloric intake orally.

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*Since this paper was submitted for publication, Darrow has reported the successful administration of potassium, in larger amounts than previously used, in diarrhea in infants.[7, 8]

# BEHAVIOR ASPECTS OF THE CARE OF THE PREMATURE INFANT

ARNOLD GESELL, M.D.
NEW HAVEN, CONN.

TO compress this subject into brief space, I shall limit my remarks to viable fetal infants, that is, preterm infants with postconceptional ages of from 28 to 40 weeks. And I shall interpret the psychology of these infants in terms of their muscle tonus, as observed in some 80 developmental examinations.

Tonus is a key concept, because tonus *is* behavior. Tonus is a condition of muscle tension, mediated by both the autonomic and cerebrospinal nervous systems. It varies with the concentration of free acetylcholine—a humoral substance which has been demonstrated to be "highly electrogenic" at the site of liberation. In this sense tonus is a property of living tissue. The dead, we are reminded, have no tonus. The dying are losing tonus. The weak have low tonus.

Therefore, at the threshold of viability all measures which safeguard and foster the function of tonus are of critical importance in the care of the premature infant. The behavior hygiene of the premature infant consists in the maintenance of optimal tonus.

What is optimal? We do not know, because the phenomenon of tonus has not been adequately studied by clinical methods. Tonus is not simply a by-product of internal and external conditions of temperature, humidity, body fluids, and metabolic level. It reacts to these factors, and can be partly controlled through them; but it has its true origin in the structural maturity of the organism. The fetal infant himself initiates the primary tonal responses. These responses organize with age. In the young, or early stage, fetal infant (fetal age 28 to 32 weeks) muscle tone is at a low level. It has three characteristics: it is fluctuant, patchy, and precarious. In the mature, or late stage, fetal infant (36 to 40 weeks) the tone has risen to a higher level. It is relatively steady, consolidated and sustained. It is also more obviously patterned and adaptive.

Tonus is patterned through growth processes, and it should be managed on a developmental basis. It is not a generalized quality or quantity which merely increases in magnitude. It is an architectured mechanism which is built into the growing nervous system.

In the youngest fetal infants tone is minimal, flaccid, and uneven. It rises, falls, and shifts above its low level. It may be comparatively high in one region, and low in another. As tonus tires it seems to "wander" to fresher areas. This

Presented at a symposium on Fetus and Newborn at the Fourteenth Annual Meeting of The American Academy of Pediatrics, Detroit, Mich., Jan. 16 to 18, 1946.

This paper is based in part on observations reported in *The Embryology of Behavior*, Arnold Gesell, M.D., in collaboration with Catherine S. Amatruda, M.D., New York, 1945, Harper and Brothers, p. 289.

meandering characteristic is probably related both to morphogenetic factors and to the physiologic mechanism of recruitment.*

Even in the midstage fetal infant the tonal responses are more integrated. His gross postural activity comes in configured waves rather than in small localized ripples. His general tonus increases on manipulation and rises to meet limited emergencies. He is not as fragile as he seems; but his tone does peter out readily.

The late stage, near-term fetal infant has more tone on tap. He does not need to husband his tone as formerly, because he has reserves of it to draw on. The whole substratum of tonus is more consolidated; he seems more firmly knit into a single, sturdy piece. He is more nearly ready to meet the buffetings of fate.

Now this progression toward organized tonus is the essence of the psychology of the fetus and of the premature infant. His mental life is mainly one of kinesthesia and tactility. His mental health has less to do with seeing and hearing. It has much to do with the satisfactions of bodily movement, and the ancient sensorium of skin and mucous membrane.

We can reach his psychic needs more fully by more adequate methods of routine care and management. I shall briefly indicate practical possibilities under four headings: (1) clothes, (2) cleansing, (3) handling, and (4) bedding.

*Clothes.*—Birth deprives the fetal infant of the snug investment of the uterus. It is idle to duplicate intrauterine conditions; but it is not impossible to restore some of their advantages. The modern neonate does not take kindly to nudity, even in a humidor. I believe that he craves the tactile and the thermal snugness of clothes. This suggests that there are virtues in a close-fitting, long-sleeved pique jacket, in cotton batting bootees wrapped about the feet and pindling lower legs with a strip of soft cloth, and a diminutive steamer-robe envelope which bundles the torso, but leaves the arms free. Tender subjects may need a bonnet as well. Ensconced papoose-fashion in such an investment, the fetal infant may be presumed to feel more at home. The comprehensive pressure upon all parts of his sensitive skin helps him to maintain a comfortable minimal level of tonus; and yet leaves him free to deploy his spontaneous, meandering tonal reactions. The slight variations in surface temperature would seem to be salutary.

*Cleansing.*—But he may also react favorably to the intensifications of stimulation which come with a brief warm bath, and a deft Dutch rub. The crying induced by the daily cleansing probably has a beneficial effect upon the pulmonary alveoli. Restored with dispatch to snug clothes the experience may well carry with it just the right amount of mild stimulation to contribute to the in-

*It is important to remember that muscle fibers work in relays and that both in muscular tonus and in active muscular contraction *the method of recruitment* prevails. Not all fibers are called and chosen at once. They are recruited by squads. This principle of recruitment is reflected in the progressions of embryogenesis. If we could witness the whole sequence of events we could see relays of recruitment in successive areas of circumscribed tonicity and in sporadic and partial contractions. But there comes a time when enough neuromotor structure has been built up to bring about a palpable movement of head and trunk. That time marks the beginning of observable overt behavior.

fant's developmental welfare. The vigor of the ministrations must, of course, be tempered to the vigor of his tonal reactivity. The complete avoidance of all such stimulation leads to the opposite danger of depressing isolation. There is a hygienic medium between excessive caution and injudicious handling.

*Handling.*—The fetal infant is not as fragile as he is supposed to be. He needs skillful handling rather than no handling at all. If he were still in the uterus, he would have the benefit of jolting, jarrings, impacts, changes in position, and travel with the activities and goings and comings of the mother. Does he not miss these experiences when he is immobilized day in, day out in an incubator?

The clothing already described makes it possible to manipulate the infant with a greater degree of safety, and to provide him with needed translations in space, stimulating his semicircular canals and his kinesthesias.

Handling should be brief, because tonus readily tires; but if it is dextrous and done with dispatch, the fetal infant is likely to acquire a quality of hardiness instead of the softness which necessarily comes with unmitigated hospitalization.

*Bedding.*—Even the bed of the fetal infant may be too soft and too stationary. The uterus is not only a garment but a bed which moves with the postural adjustments of the active mother, and even with her respirations as she sleeps. On these grounds one can make a psychological case for a mattress of resilient material, suspended on sensitive springs which yield to the stirrings of the infant. Responsive bedding imparts a sense of movement and may have a favorable effect on the development of body tone.

The foregoing arrangements tend to personalize the care of the premature infant. Under the acculturating influence of one or two months of such care he may make consistent progress. In uncomplicated cases prematurity does not disturb the normal course of development. The healthy premature infant does not acquire any unnatural precocity from his head start; neither does he suffer any setback. This should be a great comfort to his anxious mother. She should be assured that the healthy premature infant follows the basic sequences of normal mental growth, making due allowance for his spurious age.

Fortunately, the maturational insurance factors are so strongly entrenched that they protect the fetal infant to a great degree even from faulty methods of care. But if we are to bring his potentialities to the highest realization we must study more closely his total behavior economy by clinical methods of observation. His psychological needs are most clearly manifested in his basic muscle tonus and his patterns of tonal behavior.

# CONGENITAL ADRENAL CORTICAL INSUFFICIENCY ASSOCIATED WITH MACROGENITOSOMIA

## Follow-up and Terminal Report

H. E. Thelander, M.D.
San Francisco, Calif.

THE case of congenital adrenal cortical insufficiency with macrogenitosomia reported in 1941[1] has been observed for six years and to the time of death with measles on Nov. 17, 1945. The interim story and the final study of the case are reported for the purpose of making available to others the data of one more case of a disease entity still poorly understood.

R. M., a male child, the third of normal, healthy, Italian-American parents, was born on Nov. 18, 1939, weighing 7 pounds 10 ounces. The first child of the family, a boy 10 years older, is living and well; the second child, who was born in 1935, died at 5 weeks of age with symptoms similar to those of the patient. The birth of R. M. was essentially normal. The child was put to breast according to hospital routine every three hours during the day and every four hours at night. The mother had an abundant milk supply, and the infant nursed well but failed to gain. For this reason a supplementary formula was started on the seventh day. On the eighth day the weight dropped an additional 5 ounces, and the stools became frequent and green, and contained large amounts of mucus. The baby was isolated; normal salt was given by clysis; and a change of formula was made. Stool cultures revealed no pathologic organisms, and the subsequent character and consistency of the movements did not suggest an infectious origin. There was no fever. The child took his food poorly, vomited frequently, and was very listless. Diets with and without breast milk and various formulas were tried without avail. Transfusions, intravenous glucose, and normal saline by clysis were necessary to sustain him. When parenteral fluid was omitted for one period of thirty-six hours, the patient went into collapse requiring oxygen and stimulants, as well as fluids. A gastrointestinal series was done to rule out partial obstruction, such as stenosis or volvulus.

After two weeks of therapy the patient's apparent daily need of parenteral saline suggested the possibility of adrenal insufficiency as the underlying pathology. A more careful inquiry then revealed that the sibling who had died had exhibited symptoms similar to those of the patient, and a diagnosis of probable adrenal insufficiency had been made but was not confirmed since the family refused permission for an autopsy. The child had a hypospadias and probably was a female pseudohermaphrodite.

Administration of percortin was started on December 29, 0.3 c.c. being given hypodermically daily. His progress from then on was considerably better except when we resorted to experimentation. Since there was no guiding precedent and it was unknown whether or not spontaneous improvement might occur, successively gradual reduction of the dosage of percortin was tried, and administration of adrenotropic hormone to stimulate the adrenal cortex was employed, plus use of salt in the diet. However, it always became necessary to resort eventually to subcutaneous saline and percortin given hypodermically to restore him to balance. Therefore, the mother was taught to give the drug injections at home, and the patient was dismissed, to be followed in the outpatient department.

At 6 months of age enlargement of the genitalia was unmistakable; pubic hair and a low voice were noted shortly thereafter.

In August, 1940, at 9 months of age, the patient was admitted to the hospital because of vomiting and fever. A diagnosis of exanthem subitum was made, and recovery was uneventful. An intravenous pyelogram revealed no abnormalities in the kidneys. Bone age studies showed the lower, but not the upper extremities to be advanced.

From University of California Hospital, Pediatrics Department and Children's Hospital, San Francisco.

While the patient was in the hospital, desoxycorticosterone acetate for sublingual administration was supplied by Dr. Evelyn Anderson, and the patient was given 2 drops under the tongue four times daily (4 drops or 1 mg.). This dosage subsequently was increased to five times daily, and finally to 4 drops five or six times a day. The child remained well, gained weight regularly, and had a good appetite. When the new method of administration was first tried, he was restless and consumed, at times, excessive quantities of water. It was then determined that with these symptoms he needed more of the drug, and the mother varied the amount accordingly.

At 14 months of age the patient's weight was 24 pounds 12 ounces; height 82 cm.; bi-iliac crest 13 cm.; anteroposterior and lateral chest, 11 and 16 cm., respectively; sitting height, 50 cm.; and span, 77 cm. The penis was 7 cm. long, and some pubic hair was present. His bone age was that of a 3-year-old child. His fontanel was closed. He had four teeth. He walked holding on to objects, said a few words, and was bright and alert. When receiving adequate desoxycorticosterone acetate, he was happy, but if the dosage were reduced, he was restless and irritable, had a poor appetite, and drank excessive amounts of water, 10 or 15 ounces daily. Even at these times he had no craving for salt; opportunity to show such a preference had been given him innumerable times since early infancy. His diet was regular for his age and well fortified with vitamins. He showed no abnormal trends in his appetite except that he rather consistently refused sweet foods. This was not marked enough to attribute it to a peculiarity of his disease.

Further hospital admissions for acute illnesses were:

From Sept. 27 to Oct. 2, 1941, with the diagnosis of convulsion with upper respiratory infection. At this time the child had his first convulsion, a moderately severe one. The illness was treated with sulfathiazole and he continued with the sublingual therapy during the entire illness.

He was in the hospital from Dec. 10 to Dec. 18, 1942, at the age of 3 years, with a diagnosis of right upper lobe pneumonia, confirmed by x-ray. He had had a convulsion prior to admission with this illness. His white blood count was 36,600, with 71 per cent polymorphonuclears. He made an uneventful recovery on chemotherapy.

He was again in the hospital from Oct. 28 to Oct. 31, 1943, at the age of 4 years, at which time he had a tonsillectomy and adenoidectomy with uneventful recovery.

The final admission was Nov. 16, 1945. The following day he expired. The diagnosis was measles with convulsion. The story of his terminal illness is: On Nov. 15, 1945, he had a temperature rise to 100.4° rectally, with a hacking cough. The mother noticed that his throat was slightly red and his eyes were injected. On the morning of November 16, he awoke with a morbilliform rash and a temperature of 105°. He was seen by the physician at this time and a diagnosis of measles was made. Koplik spots were present. Shortly after the doctor's visit, he had a convulsion which lasted, with slight remissions, to the time of his death. At no time did he regain consciousness.

The physical examination on admission to the hospital was incomplete due to patient's condition. The temperature was 107.8°. He was unconscious, with intermittent convulsive movements. The lips were cyanotic and there was a maculopapular rash on the face and chest, heaviest near the scalp line. The nose and throat were filled with mucopus. Pupils were dilated; conjunctivae were injected.

The nose and throat were cleared by suction. He was given oxygen, phenobarbital gr. 2 hypodermically, and 5 per cent glucose and saline was started intravenously. This was interruped after 500 c.c. had been taken and he was given 250 c.c. of normal pooled human serum, after which another 500 c.c. of 5 per cent glucose and saline were given.

At 6:15 P.M. the temperature was down to 102.7°, the color improved, and he was quieter. He died at 1:30 A.M. on Nov. 17, 1945.

*Laboratory Data.*—Complete blood count: hemoglobin, 106 per cent (15.4 Gm.); red blood cells, 5,470,000; white blood cells, 9,200; polymorphonuclear neutrophiles, 59 per cent; nonfilament, 14 per cent; lymphocytes, 37 per cent; and unclassified, 4 per cent.

The following autopsy report was received from University of California Hospital:

ANATOMIC DIAGNOSIS

I. Bilateral adrenal cortical hyperplasia, extreme
  A. Aberrant adrenal cortical rests in testis, bilateral
  B. Macrogenitosomia
    1. Pupertas precox
    2. Adult body contour
    3. Hyperplasia of the prostate
  C. Persistent thymus
  D. Hypertrophy of the juxtaglomerular apparatus
II. Measles (clinical)
  A. Diffuse dermatitis (superficial lymphocytic infiltration)
  B. Generalized lymphoid hyperplasia with focal necrosis and giant cell formation (Finkeldy type)
  C. Acute tracheobronchitis
  D. Bronchopneumonia

GROSS DESCRIPTION

The body is that of a well-developed, well-nourished white male child, appearing about 13 years old (although stated to be 6). He is 58 inches long and weighs perhaps 90 pounds. Body musculature is everywhere well developed, body contours are of adult type, and there is a well-developed area of pubic hair. The penis is quite large, resembling that of an adult male. The neck is heavy and the throat large, so that the entire body contour is that of a well-developed male. The lower extremities, however, are small in proportion. There is no icterus, no peripheral edema, and no palpable subcutaneous lymph nodes. Livor, rigor, and algor mortis are present. A rather coarse macular rash is present on the face and thorax. The skin is thin, subcutaneous fat is fairly abundant and of usual color, and muscle structure is quite heavy. There is no free fluid in any of the body cavities and the organs are normally disposed. The thymus is quite large, weighing 28 grams, and covering the upper half of the anterior mediastinum. The thyroid appears of usual size, weighs 14 grams, and shows no gross changes. Numerous large lymph nodes are present, those in the mesentery measuring up to 5 cm. in diameter. Each is discrete and, on section, red and translucent.

The *heart* is of usual contour and weighs 160 grams. The epicardium is smooth; myocardium is firm, red-tan, striated, and measures 0.3 cm. on the right, to 1.1 cm. on the left. The endocardium shows no gross abnormalities, the valve circumferences being as follows: tricuspid 8 cm.; pulmonic 6 cm.; mitral 8 cm.; aortic 5 cm. Coronary ostia are patent and major coronary branches show smooth intima. The aortic intima is smooth. Vena cava and renal arteries are patent.

The *lungs* are of usual contour and weight, the right weighing 480 grams, and the left 340 grams. Pleural surfaces are smooth; outer surface is reddish, with numerous, somewhat firmer areas. The mucosa of the trachea and bronchi is extremely red and has adherent a moderate amount of thick material. The hilar lymph nodes are rather large and resemble those described in the mesentery.

The *liver* is of usual contour and weighs 1280 grams. The capsular surface is smooth; cut surface is yellowish and dotted with red. The gall bladder wall is delicate and extrahepatic biliary passages are patent.

The *pancreas* and *gastrointestinal tract* show no gross changes.

The *spleen* is quite large. The capsule is smooth. The organ is firm and weighs 140 grams. Cut surface is reddish with prominent, translucent, whitish markings.

The *adrenals* are very large. The right weighs 38 grams, the left 36 grams. They are of the usual shape. However, on section, a very narrow yellowish peripheral zone is noted, the remainder of each gland being formed by firm, hemorrhagic tissue.

The *kidneys* together weigh 195 grams. The capsule strips with ease from a smooth surface. On section, cortex and medulla are distinct. The mucosa of pelvis, ureters, and

bladder is pale and smooth. The prostate is quite small and does not project into the prostatic urethra. The *testes* weigh approximately 4 grams each. They are quite small and show the usual epididymis. On section, in each testis there is a nodule of reddish tissue which forms a central mass, each about 1.0 cm. in diameter.

The scalp, skull, and meninges show no gross changes. The *brain* appears somewhat swollen, filling the dura mater.

MICROSCOPIC DESCRIPTION

*Brain:* The vessels of the brain show no changes. Section of the brain shows grossly normal cerebellum and pons. The ventricular system is of the usual dimensions and the brain shows no gross changes. The *pineal* is distinct and 0.5 cm. in diameter.

*Heart:* The myofibrils are definitely widened for this age. They show prominent cross striations. The nuclei are long oval to rectangular. The fibrous tissue is likewise diffusely increased and a few small coronary radioles show somewhat thickened intima.

*Lungs:* The vessels throughout are greatly distended. Many areas of lung contain extravasated blood. Larger regions, however, are filled with polymorphonuclear leucocytes which form plugs within small bronchi.

*Liver:* There are no changes of note.

*Pancreas:* There are no changes of note.

*Spleen:* The sinuses are filled with blood. An occasional Malpighian body shows a small area of necrosis. In one, a multinucleated giant cell is noted.

*Thymus:* Several intact Hassall's corpuscles are noted. There are several small collections of epithelial cells. In one of these, a zone of necrosis is present.

*Urinary and bladder:* There are no changes of note.

*Skin:* Sections of skin from the thorax show collections of lymphocytes about small capillaries in the superficial derma. A few inflammatory cells are also noted about skin appendages.

*Trachea:* The mucosa is intact. Beneath it, small vessels are enormously dilated and there are numerous lymphocytes and a few plasma cells. These extend to the underlying cartilage. A moderate number of polymorphonuclear leucocytes are present as well. This reaction is seen in small bronchial radicles as well.

*Lymph Nodes:* Lymph nodes from various areas show essentially similar changes. Follicles are poorly preserved, germinal centers often disintegrated. However, there is a diffuse increase of lymphocytes throughout the nodes and occasionally there are small nests of large, pale cells suggestive of reticulum. Some of these show minute foci of necrosis. At the borders of these, an occasional large cell is noted, containing fairly abundant eosinophilic cytoplasm, the whole cell perhaps 40 micra in diameter and containing clustered central nuclei, perhaps as many as 20.

*Kidneys:* The glomeruli and cells show no changes, the capillaries being well filled with blood. However, the juxtoglomerular cells both in the glomerulus and in the distal tubules are quite large, appear increased in number, and form a prominent part of the glomerulus. The walls of afferent arterioles are of usual thickness, the tubules show no changes, and the walls of large vessels are of usual dimensions.

*Testes:* Tubules show a rather flat lining with no evidence of formation of spermatogonia. The grossly noted tumor masses are composed of sheets of cells which are poorly demarcated from surrounding testicular tissue. At the margin, this tissue surrounds an occasional tubule and appears to be extending into near-by tissue. In these regions there are occasional clumps of lymphocytes. The central areas are composed of a rather scant fibrous stroma which separates groups of large polygonal cells which are heavily demarcated and show rather abundant eosinophilic cytoplasm and round finely reticular nuclei. These cells are suggestive of adrenal cortex.

*Thyroid:* There are no changes of note.

*Parathyroid:* The glands are quite small and composed of masses of uniform cells which occasionally form small acini. These cells show scant cytoplasm and round, hyperchromatic nuclei.

*Prostate:* The stroma is quite scant. There are numerous, fairly large glands which show occasional folding of their lining. The lining for the most part is of a single cell thickness and composed of a simple cuboidal type cell.

*Adrenals:* The two glands are essentially similar. Each shows an intact capsule in which occasional clumps of lymphocytes are noted. The tissue is composed primarily of cortex which forms multiple, irregular nodules as well as a diffuse, extremely wide cortical zone. These cells are similar throughout the thickness of the cortex, no medullary tissue being identified. The cells are quite large, polygonal, and heavily demarcated with abundant eosinophilic, granular cytoplasm, occasionally containing yellow-brown granules. Nuclei are round, hyperchromatic, and show large nucleoli. Mitotic figures are not noted. Stain with Ponceau-Fuchsin.

*Pituitary:* The pars nervosa shows no change. There is a cystic area completely surrounded by glandular tissue (which in addition forms a fairly large mass). This tissue is in usual arrangement for anterior lobe and shows a marked predominance of alpha cells.

## COMMENT

The parents of this child have been very cooperative, which has made it possible to follow satisfactorily his growth and development. In Table I are listed the weights and measurements taken at about yearly intervals. Complete

TABLE I

| DATE | AGE | | HEIGHT (INCHES) | WEIGHT (POUNDS) | TEETH | BONE AGE | SEXUAL DEVELOPMENT | REMARKS |
|---|---|---|---|---|---|---|---|---|
| | MONTHS | YEARS | | | | | | |
| 11/18/39 | Birth | | | 7⅝ | | | | |
| 4/15/40 | 5 | | 25 | 13 | | | | |
| 8/ 8/40 | 9 | | | 23 | 4 | Advanced | Penis 5 cm.; pubic hair | Exanthem subitum with convulsion |
| 11/18/40 | 12 | 1 | 30½ | 22½ | 8 | | | IV urograms negative |
| 1/18/41 | 14 | | | | | 3 yr. | Voice low | Walking; training |
| 8/18/41 | 21 | | 35½ | 33½ | 16 | | Advanced | I.Q. 104 |
| 10/ 6/41 | 23 | | 36 | 36½ | | | | Blood sugar 74 mg.; blood cholesterol 441 |
| 11/24/41 | 24 | 2 | 38 | 38 | 18 | 6 yr. | Erections | ECG negative |
| 12/ 8/41 | 25 | | 38¼ | 38¼ | 18 | | | Pneumonia |
| 3/ 2/42 | 27 | | 40 | 43 | 20 | | | |
| 5/ 4/42 | 29 | | 42½ | 44½ | 20 | | | BP 80/40 |
| 7/27/42 | 32 | | 43 | 47 | | | | I.Q. 110<br>ECG negative |
| 10/12/42 | 36 | 3 | 45 | 50 | 20 | 8 to 9 yr. | | Tonsillectomy and adenoidectomy |
| 4/19/43 | 41 | | 48 | 58 | 20 | | | BP 90/40 |
| 5/19/43 | | | | | | | 27 mg.; 17-ketosteroids | Acute tonsillitis |
| 8/ 2/43 | 45 | | 49½ | 60 | | | | |
| 10/30/43 | 47½ | 4 | | | | 10 yr. | | |
| 12/18/44 | 61 | 5 | 56 | 75½ | Lost 1 lower incisor | 11 yr. | | Hemoglobin 120; RBC 6,000,000 |
| 11/ 1/45 | 71½ | 6 | 57½ | 88 | | | | |
| 11/17/45 | 72 | 6 | | | No 6-year molars | | | Died with measles |

measurements were made but only the height, weight, and a few other pertinent remarks with regard to development are given in the table. Chart I expresses more graphically the growth and development of the child.

In addition to body measurements, yearly bone age studies and several electrocardiographic studies were made. Mental ratings were taken at two different times and interviews were held with a psychiatrist from time to time regarding the mental and emotional development of this child who physically showed a marked deviation from the normal children of his environment.

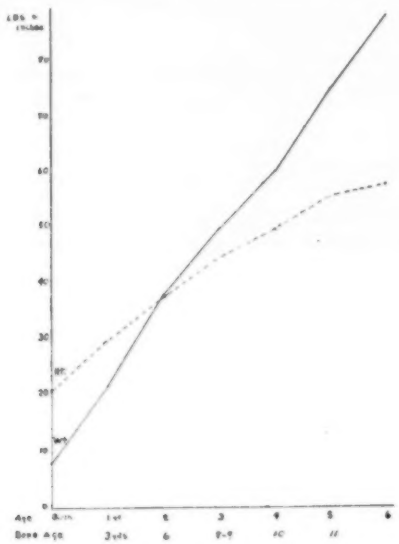
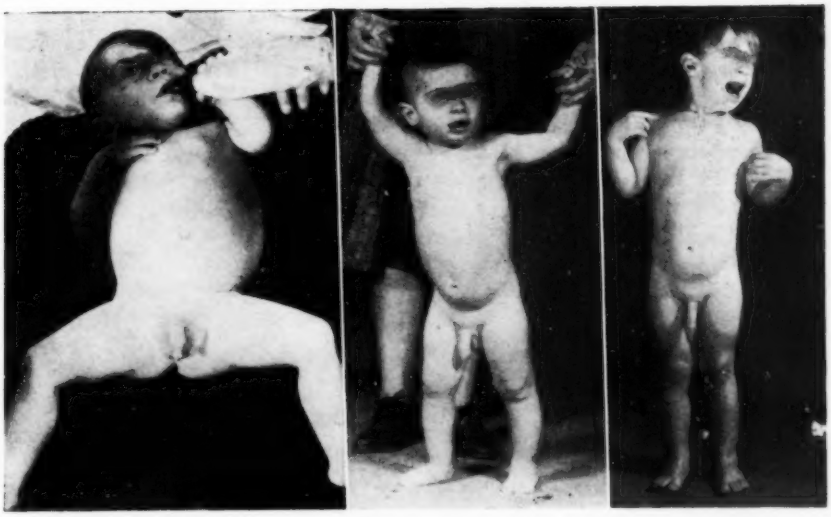


Chart I.—The height and weight curves from birth to 6 years of age and the corresponding bone age.

The table, chart, and pictures tell the story. It should be pointed out that his ultimate height, according to his scheme of growth, would have been below average. The epiphyses normally should have closed in another year or two. His ultimate height can be projected from the curve to about 5 feet. It should be noted that the facial contour, voice, and the appearance and distribution of body hair were that of an adolescent, but his testicles were small and undeveloped. His teething corresponded with his chronologic and not with his physiologic age. His feet, particularly, appeared somewhat undersize for the rest of his body, although he wore shoes the size for a 12- or 13-year-old, according to the mother's statement.

Mentally and emotionally the child was doing very well. He was in nursery school part of the time and played with the children of the neighborhood without any marked difficulty. This can be attributed to the cooperation of the parents and to their free discussion of the case with the pediatrician and with the mental hygienist. The nursery school understood the problem as did the neighbors, and it was handled in an intelligent manner by the adults in the environment. His need of hormone therapy was placed on the same basis as that



*A.* *B.* *C.*

Fig. 1.—Illustrating the development of macrogenitosomia. *A*, 8 months old; *B*, one year old; *C*, 2 years old.

Fig. 2.—Illustrating the physique at the age of 5 years and 8 months.

of insulin for diabetes or thyroid for cretinism, and it was explained that this child's growth would be abnormal for a period of years until such a time as he would reach adolescence and would fit into the normal age group. The explanation was generally accepted, and was probably the basis for the normal mental and emotional development with a minimum of complexes in regard to the abnormality. It was felt that this phase of the child's development was of great importance inasmuch as the child's normal mental development and usefulness in the future would depend upon his adjustment to society, and any physical studies which were made would be made with greater assurance and satisfaction if his emotional and mental reactions were normal.

Fig. 3.—The adrenals compared with normal specimens.

A note received by the author from the mother, dated Nov. 1, 1945, states: "He has improved in his behavior and is more self-reliant and self-confident in his activities. He has also adjusted himself very well in school."

The lack of adrenal cortical hormone was adequately demonstrated several times during the child's span of life. At first it was withdrawn intentionally to see whether or not he could carry on normal metabolism without this hormone, and in this experiment we always failed and had to resume the use of the drug. On two or three other occasions, drugs that had deteriorated were used and the symptoms recurred, necessitating the examination of the drugs for potency and resorting to the use of fresh material. The presence of the androgenic hormone

is best illustrated in the growth of the child. This child was a husky boy, strong and energetic, and showed no evidence of any lack of hormone except when he became ill. His reactions to disease were always quite severe. He had two convulsions prior to the terminal one, and ran high temperatures with rather trivial infections. However, he had handled all of his other major illnesses with sufficient ease that it was entirely a surprise to the physician in charge when his measles infection proved so severe and uncontrollable.

The anatomic findings, as had been anticipated from a study of other cases of this type, showed a marked hypertrophy of the adrenal cortical tissue. He had bilateral adrenal cortical hyperplasia which was extreme and he had aberrant adrenal cortical rests in both testes. He also had a persistent thymus. Aside from this, the organs were normal. The striated muscle of the body and the muscles of the heart were normal for a boy of his size and development. The bony structure, teeth, and organs were well formed. This is remarkable inasmuch as the child grew with extreme rapidity. There was no evidence of lack of mineralization or avitaminosis.

The etiology of this syndrome remains obscure. The occurrence of the disease in siblings with no history of abnormality in the parents remains the challenging fact in etiology. The type of cell that constitutes the hypertrophied adrenal is still a subject for controversy. The type of secretion produced by this cell is still poorly understood. A clue to the etiologic factor is undoubtedly tied up with the fetal development of the adrenal tissue, the type of secretion which this tissue produces, and the change of this tissue from prenatal to postnatal life. The existence of some peculiar maternal-fetal interpathology is suggested. Incidentally, the parents were both Rh positive.

Reporting of these cases has continued to be low, which would indicate that either the incidence is low or that the patients die in infancy and the etiology is not recognized.

Sublingual therapy proved satisfactory and so simple for administration that it is to be recommended for trial in all these cases. There was no evidence that this patient was inadequately supplied by this method of administration. The only question that might arise is whether or not during an acute illness he would have fared better with large doses hypodermically or intravenously. This question will need further investigation. As far as the overproduction of androgenic hormone was concerned, there seemed no sound method of correcting this, because aberrant rests usually have been present in the testes, and bilateral removal of some of the tissue, therefore, would not have been a logical procedure. Adrenal tissue is not very susceptible to x-ray therapy.

Longer survival of these children can be anticipated in the future.

## SUMMARY

A case of adrenal cortical insufficiency, congenital in origin and associated with macrogenitosomia, has been reported with details of the history, course, and autopsy findings.

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# CONGENITAL AORTIC ATRESIA

NORMAN H. ISAACSON, M.D., SAMUEL D. SPATT, M.D., AND
DAVID M. GRAYZEL, M.D., PH.D.
BROOKLYN, N. Y.

THE INCIDENCE of congenital cardiac anomalies varies from 5 per cent of autopsies done on infants alone[1, 2] to 1 per cent of autopsies performed on individuals in all age groups.[3] Of these, one of the rarest is the lesion to be described wherein complete fusion of the aortic cusps has occurred with resultant hypoplasia of the left side of the heart and ascending aorta. In the seven cases previously reported,[6] the maximum duration of life was fifteen weeks, the minimum two days, with an average of four days. Cardiac murmurs were heard in only two cases (one continuous throughout the cardiac cycle, the other systolic in time).

## CASE REPORT

Baby K., a white male infant, was delivered at term on Jan. 24, 1946, by low forceps. The birth weight was 6 pounds, 9 ounces (3 kg.). This was the mother's first pregnancy and it had been completely uneventful. There was no history of congenital heart disease in either the mother's or the father's family. There was no history of syphilis; the mother's serology was negative.

The baby was cyanotic and dyspneic at birth. The cyanosis increased in severity on crying. No murmurs were audible on auscultation of the heart and the lungs were described as negative. The baby was given carbogen and oxygen with temporary lessening of the cyanosis, but this soon returned and the baby expired January 26, approximately 48 hours after birth.

*Autopsy.*—Post-mortem examination performed seven hours after death showed a well-developed, well-nourished white newborn infant measuring 49 cm. in length. There was marked cyanosis of the lips and nail beds.

The principal pathologic findings were limited to the heart (Figs. 1 and 2). It weighed 18 grams (normal, 17 grams) and the epicardium was smooth and glistening. The aorta stemmed normally from the left ventricle and the pulmonary artery from the right, but there was a striking difference in size. The ascending aorta was narrowed, with a circumference of 0.6 cm. The pulmonary artery was dilated to a circumference of 1.9 cm. The aortic orifice was entirely closed by fusion of the valvular cusps and the finest probe could not be passed through it in either direction. The ductus arteriosus was widely patent and measured 0.5 cm. in circumference. Beyond the ductus, the remainder of the aortic arch and descending aorta assumed their normal caliber. The coronary arteries stemmed normally from the aorta and showed nothing unusual. A pronounced difference in size of the auricles and ventricles was also noted. The right atrium was markedly dilated and roomy, the left atrium shrunken to a mere vestige. The two atria communicated through a patent foramen ovale measuring 0.5 cm. in diameter. The left ventricle was atretic and the chamber measured only 0.7 cm. in diameter, while the right ventricular chamber was dilated to a diameter of 5.1 cm. The right ventricle overlapped and surrounded the left ventricle. Several moderately soft, grey-white areas, measuring to 0.5 cm. in greatest diameter, were scattered throughout the myocardium of both ventricles.

The remainder of the organs showed marked congestion, and the medullae of both kidneys were grossly hemorrhagic. There were a few atelectatic areas in the left lung and the right lung was completely collapsed.

From The Department of Pathology, Jewish Hospital of Brooklyn.

Fig. 1.—Heart showing hypoplastic left auricle, ventricle, and ascending aorta. The probe is through the patient foramen ovale.

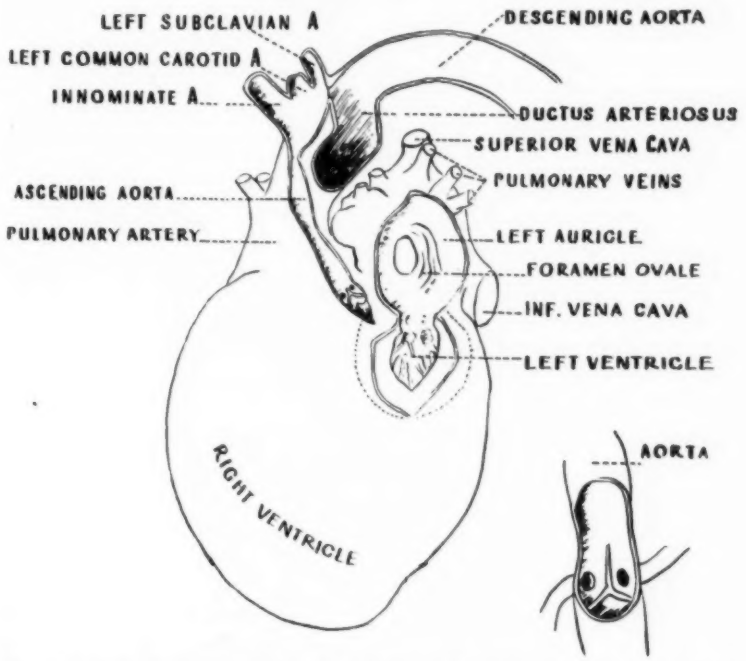


Fig. 2.—Schematic representation of the congenital anomalies of the heart in this case. (Drawing by Miss Annette Dorfman, adapted from a drawing of a similar case in Wesson and Beaver's[5] article.)

*Histologic Examination.*—Preparations from the heart showed numerous small areas and one large one in which the myocardium had been completely replaced by hyalinized fibrous connective tissue. No cellular infiltration was present in these areas (Fig. 3).

Examination of the remainder of the viscera showed passive congestion. In addition, there were hemorrhages in the kidneys, lungs, and thymus. The lungs revealed areas of atelectasis alternating with areas of emphysema. The left lung also showed hyalinized scars similar to those seen in the heart. The anterior lobe of the pituitary contained similar hyalinized areas. Extramedullary hematopoiesis was present in the liver.

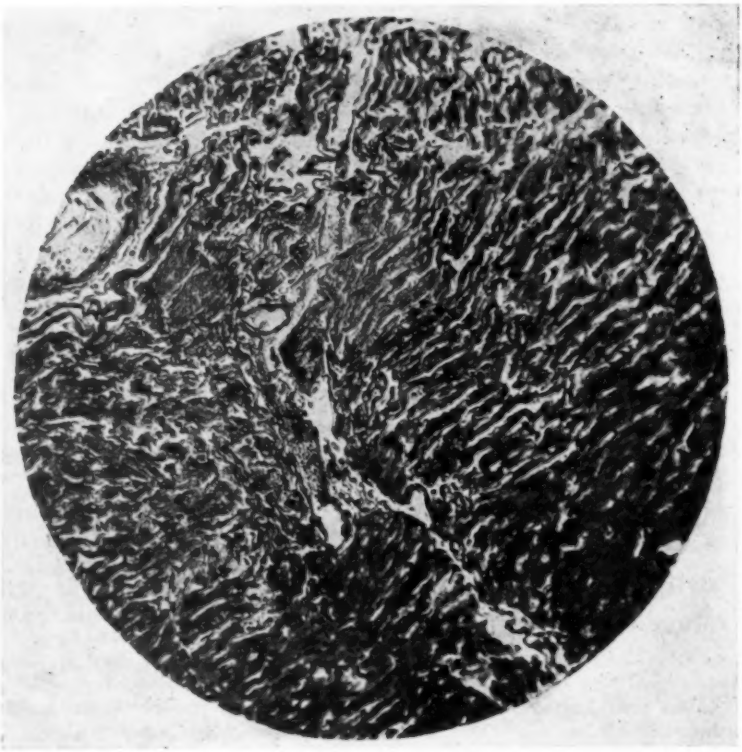

Fig. 3.—Photomicrograph of preparation from left ventricle showing hyalinized scars in the myocardium. (H. & E. ×125.)

*Anatomic Diagnosis.*—Congenital defects in heart (fusion of aortic cusps; hypoplasia of left ventricle and left atrium; hypoplasia of ascending aorta; patent ductus arteriosus and foramen ovale); hypertrophy and dilatation of right ventricle and right atrium. Myofibrosis cordis; atelectasis and emphysema in lungs; scars in heart, lungs, and pituitary; hemorrhage in lungs, kidneys, and thymus; hematopoiesis, extramedullary, in liver; congestion of viscera.

## DISCUSSION

Von Zalka[4] found (in cases of congenital pulmonary stenosis) vacuolation of the myocardial cells in the subendocardial region near the valve and infiltration with small round cells in this area. He believed the stenosis was due to

myocarditis and endocarditis during fetal life. Other observers[5] reported similar findings in cases of congenital aortic stenosis. In our case, the focal areas of scarring in the myocardium may be interpreted as healed fetal myocarditis. It can be assumed that infection of the aortic valve took place after formation of the heart had been completed, but early in fetal development while the organ was still small. With atresia of the aortic orifices proportionate growth of the left ventricle and ascending aorta ceased, so that at birth these units appeared as rudimentary or extremely hypoplastic structures. The right ventricle, of necessity carrying the entire circulatory load, became dilated and hypertrophied. Similarly, the ductus arteriosus was extremely large because it had been forced to perform not only its normal function but also that of the ascending aorta.

The left auricle and ventricle, obviously, were nonfunctioning. The blood reached the general circulation through the widely patent ductus, which also transmitted the blood in retrograde fashion to the coronary vessels. Blood entering the left auricle through the pulmonary veins, passed through the patent foramen ovale and then into the general circulation by way of the right ventricle.

## SUMMARY

A case of congenital atresia of the aortic orifice, with widely patent foramen ovale and ductus arteriosus, and hypoplastic left auricle, ventricle, and ascending aorta is presented and the pathogenesis discussed.

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# FOREIGN BODY IN DUODENUM CAUSING URINARY DISTURBANCE

E. T. McEnery, M.D., and Paul F. Fox, M.D.
Chicago, Ill.

THE FOLLOWING case is reported because of the unusual findings associated with the presence of pyuria in a child, aged 2 years.

R. Q., 2 years old, male, was admitted to The Children's Memorial Hospital, June 22, 1945, with the following history:

In October, 1944, the child had a high temperature, nausea, and vomiting associated with a sore throat. At this time his urine was examined and found to contain albumin and pus cells. He was given medication and kept in bed. His temperature returned to normal but the urine continued to have albumin and contained pus and blood cells.

Since this time he had frequent bouts of temperature with sore throat. At these times the urine showed albumin and contained excessive numbers of blood and pus cells. After the temperature would drop, the albumin would decrease but the pus and blood cells would persist.

*Past History.*—Patient was the first child. There was no history of miscarriages. His birth was normal and he had had no serious illness except occasional upper respiratory infection. Development: First tooth erupted at 5 months; walked, 10 months; talked, 17 months.

*Physical Examination.*—Revealed a well-nourished and well-developed male child, 2 years old, not acutely ill. Physical findings were essentially negative. Abdomen was soft, no tenderness noted, nor were any masses palpable. External genitalia were normal. Urine: Slightly cloudy. Albumin 4 plus. Benzidine 2 plus. Microscopic examination showed no casts, numerous blood cells, and many pus cells.

*Cystoscopic Examination.*—Bladder essentially normal.

*Intravenous Pyelogram.*—(Fig. 1.) X-ray of the abdomen showed a bobby pin in the second and third portions of the duodenum. Films made at intervals after the intravenous injection of dye showed good visualization of the pelvis, primary and secondary calices, and ureters on both sides. Only the upper half of the right ureter was clearly set out and this appeared to be several times the diameter of the upper portion of the left ureter.

The finding of the bobby pin was a surprise. The mother was questioned and she did not recall the child having had choking spells or any difficulty in swallowing. How long the pin had been present in the duodenum was not known. The child was sent home for a further period of observation, in the hope that if the pin had been there only a short while it might pass.

After two weeks he returned to the hospital. Another x-ray was taken and the pin was found to be in the same position. He was admitted to the hospital preparatory to an exploratory laparotomy and removing the pin.

*Operative Procedure.*—On July 19, operation was performed under ether anesthesia. A right paramedian incision was made in the upper abdomen and the right rectus muscle was retracted laterally. Upon opening the peritoneum, extensive adhesions were seen between the transverse colon, inferior margin of the liver, and gall bladder. In fact, the hepatic flexure and proximal transverse colon were attached along the entire inferior margin of the right hepatic lobe and the gall bladder was not visible. Dissection was begun where the colon was adherent to the liver edge and continued downward until the duodenum was seen. Some periduodenal adhesions were then separated and the duodenum palpated. The foreign body (bobby pin) could be felt in the third part of the duodenum just proximal to the prominence formed by the vertebral column and it seemed to be rather firmly embedded.

The Children's Memorial Hospital.

Palpation of the right kidney in close proximity to the second and third parts of the duodenum revealed that the upper pole and renal pelvis were involved in the periduodenitis. There were many inflammatory adhesions in this region and the kidney seemed distinctly thicker and more fixed than usual. An attempt to gently manipulate the foreign body so that it could be pushed back into the stomach was not successful. The anterior duodenal wall was grasped with two Babcock forceps about one and one-half inches apart and a small incision in the longitudinal axis of the bowel was made. Through this incision a curved forceps was introduced with which the bobby pin was grasped and withdrawn.

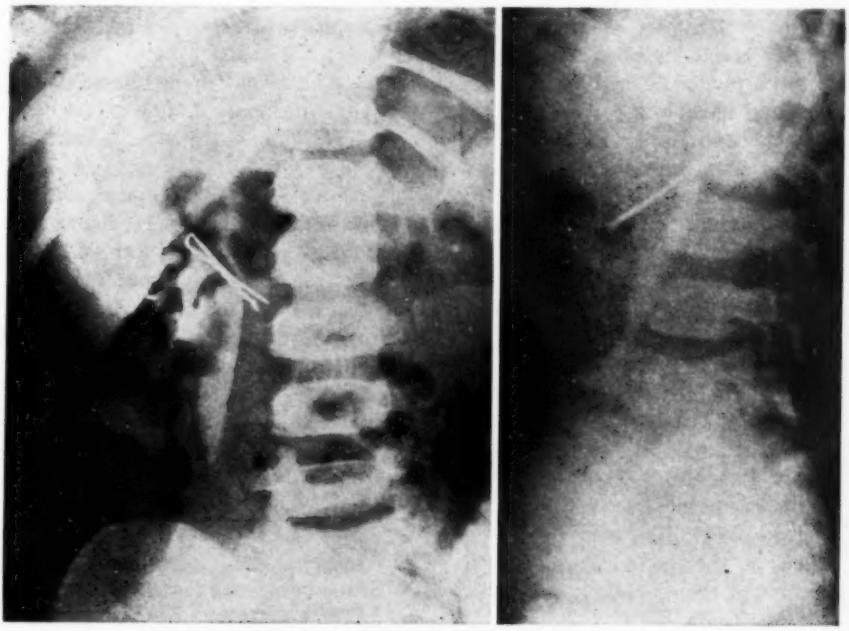

Fig. 1.—Lateral and anteroposterior views of abdomen showing bobby pin and dilated right ureter.

*Postoperative Course.*—The postoperative course was uncomplicated except for a small abscess which was evident at the upper end of the incision. This was evacuated on the seventh postoperative day and healing occurred promptly.

Specimen of urine on July 26 failed to show any albumin and no pus or blood cells.

Specimens of urine examined in August and September failed to show any albumin or any pus or blood cells.

## COMMENT

Bobby pins, when swallowed by children, cause considerable trouble because they are a little too long to make the turn at the fixed portion of the duodenum. This case stresses the importance of a complete genitourinary tract study when albumin persists in the urine of a child. How long this foreign body had been present is not known but it possibly was causing trouble months before the original urinary trouble was noted in October, 1944.

# MALIGNANCY OF THE GENITOURINARY TRACT IN CHILDREN

## Report of a Case of Sarcoma of the Vulva

Allen C. Service, M.D., and R. C. Derbyshire, M.D., M.S.
Albuquerque, N. M.

GYNECOLOGICAL tumors in infancy and childhood are not considered to be a common occurrence. Malignancy in the female genital tract in children is seldom, if ever, encountered.

In a review of the literature of some 1,500 cases of malignancy in childhood, we found about 0.1 per cent occurring in the genital tract. Most of the cases reviewed were reported as occurring in the eye, kidney, or bone. About 85 per cent of these proved to be sarcomas.

Wolff[1] in a survey of 11,000 cancer cases collected from several sources, found only 4.2 per cent in patients under 30 years of age. Kellert[2] found only 15 malignant growths in children under 16 years of age in a total of 2,050 malignant tumors of all kinds, or a ratio of one childhood tumor to 137 in adults. Simpson[3] reported the case of a botryoid tumor of the cervix in a girl 14 years of age. Knight[4] reported the case of a sarcoma occurring in the uterus of a girl 9 years of age. This was apparently treated successfully by roentgenotherapy. Kelly[5] gives an account of a melanoma of the vulva occurring in a child 14 years of age, which was treated by excision but resulted in metastasis and death two and one-half years after the onset of the first symptoms. Baldwin[6] excised a primary medullary squamous carcinoma of the vagina occurring in a girl 14 years of age. This was the only case, proved by microscopic studies, in a patient under 20 years of age in 905 cases of cancer found in the vulva, vagina, cervix and corpus. Glass[7] reported a case of sarcoma of the cervix in a girl 16 years of age, which was proved by microscopic studies. Ludwig[8] found a sarcoma of the cervix in a girl 16 years of age. This was treated by means of radium and x-ray therapy. Scheffey and Crawford[9] reported a case of adenocarcinoma of the cervix in an infant 22 months old. Lockhart[10] reported an extremely rare case of adenocarcinoma of the corpus uteri, which occurred in a child 3 years and 2 months of age. Taussig[11] removed a sarcoma of the vulva, which was somewhat similar to the case we are reporting. The original lesion was first noticed in the vulva when the patient was 7 months old, and grew gradually until surgically removed when she was 14 months old. Four months later, a tumor appeared on the opposite labium and surgical removal was again the procedure of choice. The tumor in Taussig's case proved to be a sarcoma of relatively low malignancy.

Malignancy of the female genitalia, occurring in children, is so rare that we feel justified in reporting this unusual case:

A white female, aged 3 years, was brought to the clinic because of a large mass protruding from the external genitalia. When the child was 13 months of age, bleeding from the vaginal orifice was noticed. Investigation by the mother revealed a small red, pea-sized

From the Departments of Pediatrics and Surgery, Lovelace Clinic.

nodule just inside the labial fold. The bleeding was not severe and the nodule disappeared. At 16 months of age, a small nodule reappeared at the site of the original lesion. This did not bleed, but continued to grow—at first slowly and then began to protrude outside the labia. No medical advice was sought until the child began to lose weight. The mass was so large at that time that she was unable to walk.

The family history was irrelevant except for cancer of the stomach in the paternal grandfather. He was operated upon in 1941, and was in good health. There were three siblings living and well. There was no history of miscarriage or abortion.

Fig. 1.

Examination revealed an emaciated child, tossing her head from side to side in apparent discomfort or pain. She responded to questions, but did not talk coherently. Her skin was dry and muscle tone poor, giving the appearance of rapid weight loss over a short period of time. Examination of the eyes, ears, nose, and throat did not show any abnormal findings. There was visible pulsation of the vessels of the neck. Cardiac impulse was seen at the left nipple line at the sixth interspace and was rather diffuse. No thrills were felt, and the heart rate was rapid and regular. There was a harsh systolic murmur heard over the precordium, more pronounced at the apex and transmitted to the axilla. Blood pressure was 110/95. Respirations were rapid and regular, and no râles or abnormal breath sounds were heard. The abdomen was distended, but there were no palpable masses and no apparent tender areas. Peristalsis was active. Protruding from external genitalia was a fungating tumor mass the size of a large grapefruit (Fig. 1). The surface was reddish, cauliflower-like in appearance, and covered with a reddish-gray exudate. It was impossible to determine the origin of the tumor because of its adherence to the external genitalia. On rectal examination there was no obstruction or abnormal findings. Urination was frequent, but it was impossible to observe

the external urethra or the opening through which the urine drained. The muscle tone was poor in the extremities, but she was able to move her arms and legs voluntarily. There were no sensory disturbances. The lymph nodes were not enlarged in any part of the body, and hardly palpable in the inguinal region. The skin was dry and rough, but there were no areas of discoloration, and no rash or skin lesions of any kind. Impression at this time was of a tumor mass of the external genitalia, probably malignant.

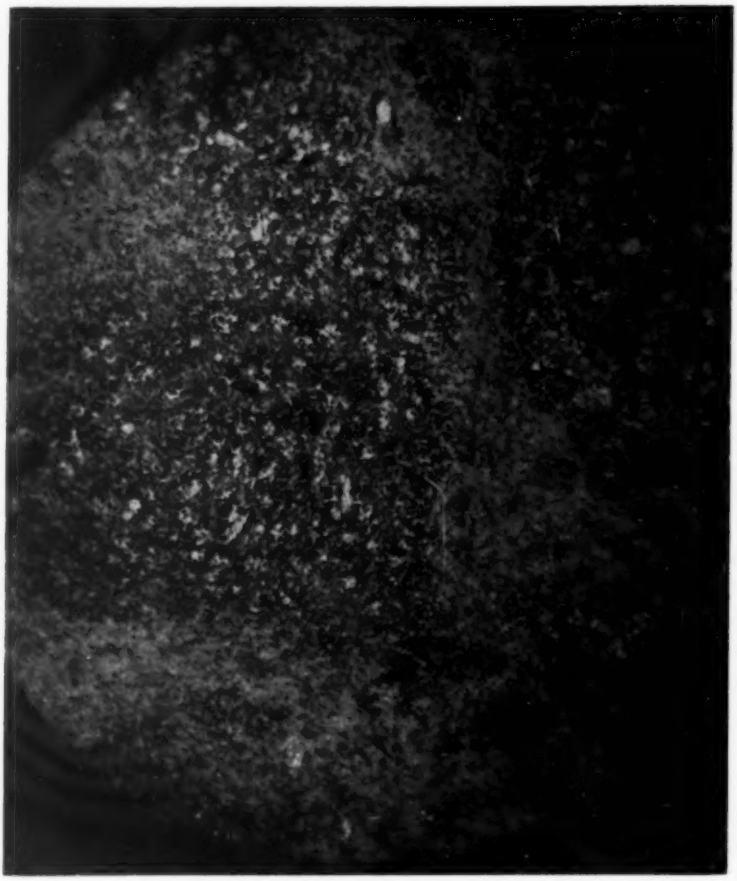

Fig. 2.

She was hospitalized and given a transfusion of whole blood. Penicillin compresses were kept constantly on the tumor mass. Methylene blue was given by mouth in an attempt to determine the location of the urethral orifice. The dye was excreted, but came from beneath the mass and we were unable to determine the exact location of the urethra. Attempts to pass a small rubber catheter through several of the crypts into the bladder were unsuccessful. Her general condition improved and her appetite was good. X-rays of the chest did not reveal any pathology in the lungs, and the heart size and shape were within normal limits. Blood count and urinalysis were normal. After one week of hospitalization, her condition had improved and surgical removal of the tumor was undertaken.

On June 4, 1945, under ether anesthesia, it was possible to carry out a more detailed examination prior to operation. The tumor was found to arise from the left labium minor by a rather wide pedicle. It completely filled the vagina and there was a large amount protruding outside. The urethra was displaced upward, forward, and to the right and was markedly angulated. An extension of the tumor was seen over the left side of the mons pubis.

An elliptical incision was made over the portion of the tumor which extended over the mons pubis and it was dissected free with ease. The incision was then extended downward into the vagina and into the left labium minor. The upper portion of the growth appeared to be encapsulated but the lower portion was dissected out with considerable difficulty as it infiltrated the left vaginal wall rather deeply. The resulting defects over the mons pubis and the vagina were sutured with interrupted chromic catgut. A retention catheter was placed in the bladder.

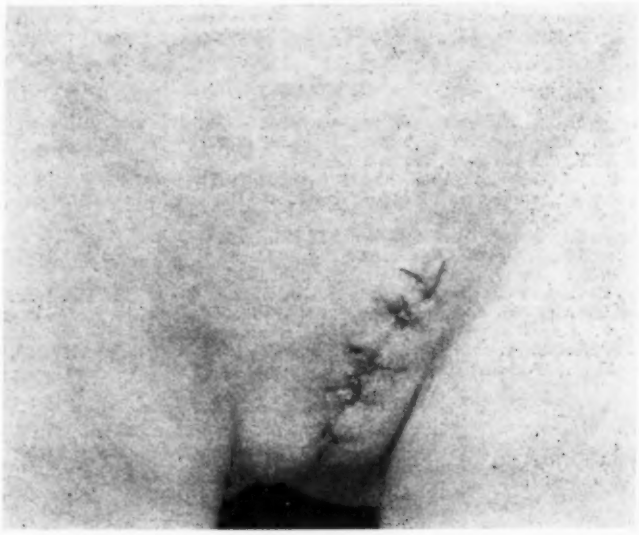

Fig. 3.

*Pathologic Report.*—The specimen consisted of two tumors. The larger measured 13 by 10 by 7.5 cm. and weighed 508 grams. It was reddish-yellow in color and its external surface was lobulated and friable. Its cut surface was white and its central portion firm. The smaller tumor measured 5 by 3 by 2.5 cm. It was covered by skin and appeared to be encapsulated. Microscopically, both tumors appeared essentially alike. They were composed of loose fibrous tissue which, in many places, appeared myxomatous. Throughout this were scattered many collections of large, polygonal cells arranged irregularly and varying in size and shape. Their nuclei were large, varying in shape from round to oval and there were many mitotic figures. (Fig. 2.) A diagnosis of fibromyxosarcoma was made. The sections were also studied by Dr. A. C. Broders, who confirmed the diagnosis, considering the tumor to be of grade two malignancy, according to his classification.[12]

*Course.*—The wound healed per primum. The retention catheter was removed on the seventh postoperative day, after which the patient voided and had good sphincter control. Her convalescence was complicated by persistent tachycardia, generalized edema, and accentuation of the pre-existing systolic murmur. However, the edema and tachycardia disappeared after the administration of digitalis. The patient was dismissed from the hospital June 17, 1945, on the fourteenth postoperative day with the wound completely healed. She was able to walk without assistance. (Fig. 3.)

The patient was readmitted to the hospital on June 29, 1945, with a history of acute retention. She was found to have a urethral stricture which was dilated under anesthesia.

The patient was next admitted Nov. 22, 1945. She had been feeling well, had been leading a normal life for a child of her age but had not gained weight and had had urinary incontinence for two months. Physical examination revealed moderate bilateral enlargement of the inguinal lymph nodes. On the left vaginal wall there was a red nodule measuring 0.5 cm. in diameter, which the mother stated resembled the original tumor. Roentgenogram of the chest was negative. There was no evidence of intra-abdominal extension of the tumor.

On Nov. 23, 1945, because of the lack of evidence of distant metastasis and the apparent localized involvement of the regional lymph nodes, bilateral radical dissection of the inguinal nodes was carried out, and the nodule in the vagina was excised.

Microscopic examination of the lymph nodes from the left side did not reveal any evidence of tumor. Those from the right side showed a small area of tumor which essentially resembled the original growth but was somewhat more cellular. The nodule in the vagina was granulation tissue and did not show any evidence of malignancy.

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# A MODIFICATION OF THE BRECHT FEEDER

JEAN G. HESS, R.N.
ROCHESTER, N. Y.

FEEDING the infant with oral deformities or the physically or mentally inadequate child has always been a problem to the physician and nurse. This is especially true at the present time when, because of the shortage of trained help, the half-hour or more necessary to feed the infant must be cut to the minimum although an attempt must be made to satisfy the child's emotional as well as physical needs. The Brecht feeder is a type of bulb syringe to which a nipple can be attached and the milk drops into the infant's mouth as though he had secured it himself with normal sucking power. He swallows the milk and has the satisfaction of feeding in as nearly a normal manner as is possible. The modified Brecht feeder described here was designed primarily to meet the needs of these infants and to make it easier for the person feeding the baby. I have noted in many instances that an ordinary bulb syringe with a piece of rubber tubing attached is more successful than the Brecht feeder because the opening of this feeder is usually too small for an ordinary nipple to be attached, and the nipple furnished with most feeders is too long and narrow, causing the infant to gag or vomit, or else it wears out before the feeder does. In addition, one of the main advantages of a feeder is lost, namely, the satisfying of the sucking reflex.

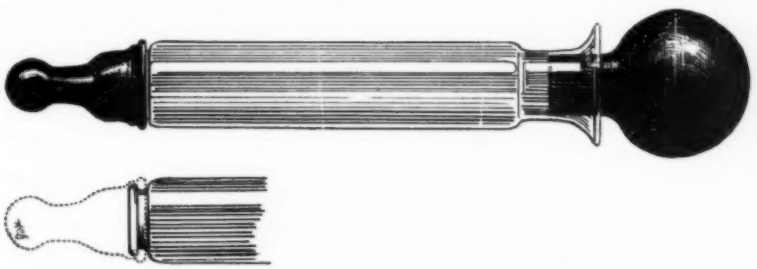

Fig. 1.

In correspondence with the research departments of various companies engaged in making infant feeders, I learned that they are under the impression that the feeder is used primarily for the premature or immature infant. This I do not believe is the case. It has been my experience that premature infants are usually fed by gavage or dropper if unable to nurse from a bottle. The greatest percentage of feeding problems occur in those infants who cannot create sufficient suction to nurse from a bottle because of weakness, oral

Supervisor of Pediatric Nursing and Instructor in Pediatrics, Genesee Hospital School of Nursing.

This work was aided by a grant from the Johnson & Johnson Pediatric Research Foundation.

deformities, or mental deficiency. In these infants gavage may be difficult because of the strong gag reflex or because of the danger of aspiration or of upsetting the infant physically and emotionally when feeding should give comfort and pleasure.

The feeder illustrated in Fig. 1 is designed like the Brecht feeder except that the opening is very much like the neck of an ordinary nursing bottle so that a nipple for a normal infant may be used. Most hospitals have two sizes of nipples, a larger for normal and a smaller for premature infants. Both fit this feeder, so either may be used. The glass is treated to withstand heat and is marked for measuring. It is my belief that this modification of the Brecht feeder should prove invaluable to those caring for infants who need the aid of this type of feeder.

The modified Brecht feeder described may be obtained from the Glasco Products Co., 11 North Canal St., Chicago, Ill.

# American Academy of Pediatrics

## Proceedings

### MEETING OF REGION I

HOTEL PENNSYLVANIA, NEW YORK, N. Y., APRIL 3, 1946

### COOPERATIVE NATIONAL PLANNING FOR IMPROVING CHILD HEALTH SERVICES

**Panel Discussion**

Introduction. Stanley M. Nichols, M.D., Chairman, Committee on Cooperation With Governmental and Medical Agencies

Representative of Council on Medical Service and Public Relations, American Medical Association. Louis H. Bauer, M.D., (Member of Board of Trustees, American Medical Association)

Representative of the Children's Bureau, United States Department of Labor. A. Leonard Van Horn, M.D.

Representative of United States Public Health Service. E. H. Coffey, M.D., United States Public Health Service

Representative of the American Academy of Pediatrics. Joseph S. Wall, M.D., Chairman, Committee on Legislation

DR. STANLEY M. NICHOLS.—The greatest organization in this world today is the United Nations Organization. Peace, progress, and probably the survival of civilization itself depends on its success in developing real cooperation between the nations of this world. The greatest need in the American child health world today is to insure peace and progress by the voluntary, wholehearted cooperation of Government and medical agencies, working for better child health.

The greatest step forward the American Academy of Pediatrics can now take is the immediate sponshorship of a small national child health conference, meeting regularly, composed of the official representatives of the Federal and medical agencies working in the child health field.

Such a conference could study and promote definite existing areas of agreement, such as the present Maryland State Medical Society Plan, which uses governmental funds for families unable to provide good health care from their home resources.

Our committee's progress to date: Our Committee on Cooperation with Governmental and Medical Agencies, chairmaned by Dr. Martha Elliot of the Children's Bureau during the last two years, and your chairman has been the sufferer for the last seven and has worked steadily to promote the cooperation of the Governmental and medical agencies at both state and national level.

In case you are interested, copies of the State and National programs, approved by the Academy in 1941 and 1945 will be available at the registration desk at the end of this morning's session.

The Committee's program for the coming year: During the coming year, our committee will do three things. First, reactivate the State programs of our forty-eight State commit-

tees, who were doing first-class work before the war. Second, by request act as advisors to the Bureau of Food and Drugs of the Federal Security Administration as to drugs used in children, through a special subcommittee headed by Dr. Harold Murray of Newark. Third, and most important, promote our national program, particularly section four, which reads: "The Committee should aid in the formulation and coordination of the child health activities and program of Federal agencies, with those of the American Medical Association and the American Academy of Pediatrics. The Academy should sponsor a child health conference, meeting regularly, composed of representatives of the Federal and medical agencies working in the child health field to carry out this year this formulation."

On this panel you see for the first time in history the representatives of the four key Federal and medical agencies working in the child health field, voluntarily discussing cooperative national planning for improving child health service. In this key group, the American Medical Association represents the physicians of this country, the United States Public Health Service, public health, the Children's Bureau speaks for child health and welfare, and the Academy represents the pediatricians.

If our Academy, in its wisdom, now proceeds to sponsor a voluntary national child health conference of these agencies, empowered to confer regularly as to the formulation and coordination of improved child health service, of both Federal and medical agencies, we would immediately give a solid foundation to the growing American child health structure of the future. This would also provide, in the spirit of the Golden Rule, a practical means for the composition of divergent views as to methods of insuring better health for American children.

The pride and glory of our American democracy lies in the voluntary efforts of its citizens for the public good, made possible only by the exercise by free men of free speech, a free press, and the right of assembly. Superimposed on the health activities of our Governmental agencies are the splendid health achievements of our five national health professions and our twenty thousand voluntary health agencies.

Our national health is still the finest of any large country in the history of the world. This is true in spite of the present spring housecleaning of cobwebs from our twenty thousand voluntary health agencies by the National Health Council now under way and the streamlining of Federal agencies by the President and Congress.

Further improvement in child health services for American children largely depends on the voluntary, sincere cooperation of governmental and medical agencies, given factual expression from a working child health conference.

I trust our Academy will promote both peace and progress in our national planning for improving child health service by taking this essential step forward now. In the words of a great philosopher, "War, controversy, breed on suspicion. Peace walks hand in hand with truth and understanding."

DR. LOUIS H. BAUER.—Ladies and Gentlemen: I know you are primarily interested in pediatrics, but I think in order to tie in the pediatric problem into the general health problem, we will have to consider them together. So if you will bear with me, I am going to spend just a few minutes on the program of the American Medical Association as it pertains to health in general.

I think you are all familiar with the program which was announced last summer by the A. M. M.—the so-called fourteen-point program—many items of which have already become obsolete and have had to be changed. But briefly, the salient point of the program was the economic factor—that is, there is no question but that poverty breeds illness. But we feel that the answer, or the solving of the problem is not the pouring in of more medical care, but in the elimination of poverty, and that, of course, is an economic problem and not a medical one.

There are too few public health and preventive medicine facilities in the country, and it probably would not be possible for every county to have a full-time health department, because of, in some areas, scarcity of population and the expense. But we feel that neighboring counties could join together with a district health service and traveling laboratory, which

would cover, and where the states themselves could not afford to finance the entire project, the Federal Government could come into the picture. Also, there is an inadequate distribution of physicians, and one of the main reasons for that is inadequate hospitalization facilities and inadequate diagnostic facilities. The physician who is a good physician wants to remain such, and he cannot remain such unless he has the proper facilities to carry on his profession in the modern way. There again, where the states are unable, or the localities are unable to provide the necessary hospital and diagnostic facilities, the Federal Government can come into the picture, as is proposed in the Hill-Burton Bill, and the state is to retain control over the administration of these facilities.

Another point which is essential, and I think in any program we must bear in mind that you cannot pick out any one feature and say, "This is going to solve the problem," because it will not. It is everything together. It is the question of insurance. As you know, there are two schools of thought on that. One believes in the compulsory system, and the other believes in the voluntary system.

The A. M. A. has stood out for the voluntary system, holding that the compulsory system was not the American way of doing things, and that its experience with it elsewhere did not lead to the best type of medicine. I am not going to argue on compulsory insurance now. There is not time. I think you are all familiar with the arguments on it. But of course, the criticism of voluntary plans has been that they will not fill the bill, and they were not widespread enough. Of course, that second criticism, they were not widespread enough, I think has been justified. They have not been up to the present time, but that they will not, I think is not a fair criticism, because I do not think they have had the opportunity yet to show what they can do.

When this voluntary program was first suggested, no one knew anything about it at all. There was no actuarial background, and no one knew how the patients and doctors would react to it and what coverage should be given. Consequently, it was felt best to begin in a small way and experiment in various areas of the country to see what would work out and what would not; as a result of that, in the last number of years, a great deal of information has been obtained and now we feel we know pretty well what is required.

The American Medical Association has only last month set up a division of Medical Care Plans, with a director in charge, with the idea of stimulating the development of these plans where there are none at present and expanding those that are not yet covering great enough areas, and to give them help in every way, so that the whole country can be covered.

There are some twenty-seven states now that have these plans, and it is hoped that at the end of this year there will be forty states covered, and we hope in five years, or less, the entire country will be covered.

In addition to that, of course, we have many industrial plans and commercial insurance, so that a large percentage of the population is already covered in some degree—not as much as it should be and not as many people covered—but I think we have come to the point now where things are going to move fast.

I think you are familiar with the proposition in New York recently, where the Governor appointed a commission to investigate the question of health in New York State, and after two years of study, this Commission just rendered a report—or I better say reports; I think there are four altogether. They could not agree, but all but one man did agree that now was not the time to start compulsory insurance.

In any program we have to enlist the cooperation of everyone in order to make it work, and at the present time I do not think we are going to get the cooperation of the bulk of the medical profession in any compulsory plan—unless it can be definitely shown that the voluntary program will not work, which definitely has not been shown up to the present time. I mean this fourteen-point program. And in February, it was felt it was time to revise that, streamline it, and bring it a little more up to date, and that has been published. It is not very long, and as Dr. Nichols tells me he thinks many of you may not be familiar with it, I am going to read it to you. It is entitled "The National Health Program of the American Medical Association."

1. The American Medical Association urges a minimum standard of nutrition, housing, clothing and recreation as fundamental to good health and as an objective to be achieved in any suitable health program. The responsibility for attainment of this standard should be placed as far as possible on the individual, but the application of community effort, compatible with the maintenance of free enterprise, should be encouraged with governmental aid where needed.

2. The provision of preventive medical services through professionally competent health departments with sufficient staff and equipment to meet community needs is recognized as essential in a health program. The principle of Federal aid through provision of funds or personnel is recognized as essential in a health program. The principle of federal aid through provision of funds or personnel is recognized with the understanding that local areas shall control their own agencies as has been established in the field of education. Health departments should not assume the care of the sick as a function, since administration of medical care under such auspices tends to a deterioration in the quality of the service rendered. Medical care to those unable to provide for themselves is best administered by local and private agencies with the aid of public funds when needed. This program for national health should include the administration of medical care including hospitalization to all those needing it but unable to pay, such medical care to be provided preferably by a physician of the patient's choice with funds provided by local agencies with the assistance of Federal funds when necessary.

3. The procedures established by modern medicine for advice to the prospective mother and for adequate care in childbirth should be made available to all at a price that they can afford to pay. When local funds are lacking for the care of those unable to pay, Federal aid should be supplied with the funds administered through local or state agencies.

4. The child should have throughout infancy proper attention including scientific nutrition, immunization against preventable disease and other services included in infant welfare. Such services are best supplied by personal contact between the mother and the individual physician but may be provided through child care and infant welfare stations administered under local auspices with support by tax funds whenever the need can be shown.

5. The provision of health and diagnostic centers and hospitals necessary to community needs is an essential of good medical care. Such facilities are preferably supplied by local agencies, including the community, church, and trade agencies which have been responsible for the fine development of facilities for medical care in most American communities up to this time. Where such facilities are unavailable and cannot be supplied through local or state agencies, the Federal government may aid, preferably under a plan which requires that the need be shown and that the community prove its ability to maintain such institutions once they are established. (Hill-Burton Bill)

6. A program for medical care within the American system of individual initiative and freedom of enterprise includes the establishment of voluntary nonprofit prepayment plans for the costs of hospitalization (such as the Blue Cross plans) and voluntary nonprofit prepayment plans for medical care (such as those developed by many state and county medical societies). The principles of such insurance contracts should be acceptable to the Council on Medical Service of the American Medical Association and to the authoritative bodies of state medical associations. The evolution of voluntary prepayment insurance against the costs of sickness admits also the utilization of private sickness insurance plans which comply with state regulatory statutes and meet the standards of the Council on Medical Service of the American Medical Association.

7. A program for national health should include the administration of medical care, including hospitalization, to all veterans, such medical care to be provided preferably by a physician of the veteran's choice, with payment by the Veterans' Administration through a plan mutually agreed on between the state medical association and the Veterans' Administration.

8. Research for the advancement of medical science is fundamental in any national health program. The inclusion of medical research in a National Science Foundation, such as proposed in pending federal legislation, is endorsed.

9. The services rendered by volunteer philanthropic health agencies, such as the American Cancer Society, the National Tuberculosis Association, the National Foundation for Infantile Paralysis, Inc., and by philanthropic agencies such as the Commonwealth Fund and the Rockefeller Foundation, and similar bodies have been of vast benefit to the American people and are a natural outgrowth of the system of free enterprise and democracy that prevail in the United States. Their participation in a national health program should be encouraged and the growth of such agencies when properly administered should be commended.

10. Fundamental to the promotion of the public health and alleviation of illness are widespread education in the field of health and the widest possible dissemination of information regarding the prevention of disease and its treatment by authoritative agencies. Health education should be considered a necessary function of all departments of public health, medical associations and school authorities.

Now, in addition to that program, I think you are probably familiar with the fact the House of Delegates of the A. M. A. last December asked the Board of Trustees to investigate the advisability of establishing a national health congress, in which the various medical associations and organizations concerned with public health, and other organizations interested in the problem of health, should be brought together for national planning for the future in public health. That program is now in the throes of study, and we felt that there is not much use in establishing a national congress until we are assured of cooperation on the state and county levels. In the national organization, you cannot do the work; it must be done locally, no matter what you take, health or anything else. The real spadework must be done locally.

Consequently, a survey is now going on in all the states to determine what arrangements various localities now have for bringing together these various groups for handling local problems within the county or within the state, and as soon as that information is assembled, and also information as to what their plans are for developing this further, then it is hoped that some national get-together can be arranged. But I think it will have much more chance of success if we have assurance of cooperation on the lower level first and build it from the ground up, rather than from the top down.

DR. A. LEONARD VAN HORN: Dr. Eliot wished to have me express to you her regrets for not being able to be here today to attend the meeting and participate in the discussion. She, as you probably all know, has health hearings on health legislature now being conducted in Washington, and she felt it was important that she stay there. I gather from the morning paper that there is considerable heat down there. They apparently had a rather stormy session with the committee yesterday.

I really appreciate sincerely the opportunity of coming here and participating in this panel discussion. I particularly like the title for the topic, the first word particularly, which is "cooperation," and that is certainly what we would like to see more of.

During the past two years, I have also had the privilege of being a member of Dr. Nichol's committee and of working with them and considering the various methods of cooperation and how they can be worked out, both on the state and on the national level, and we hope something can come out of that.

I personally believe that this Committee carries one of the most important responsibilities in the Academy, and it can contribute to sound planning and development of an orderly and productive basis for cooperation between the Academy and all the Federal agencies concerned with the health and welfare of children, including the Children's Bureau.

My remarks are going to be pretty brief. I have felt it would be of perhaps even greater interest in the interpanel discussion that will follow, because I know, for example, I have a few questions that have come to my mind since Dr. Bauer has made his remarks. I think perhaps there will be others. But certainly, I think that we would like to see that interplay of thoughts and ideas after we hear these opening statements.

The Children's Bureau is the agency of the Federal Government which for more than thirty years has been given the responsibility by Congress for investigating and reporting upon all matters pertaining to the health and welfare of children among all classes of our people.

Since 1935, it has been charged with the responsibility for the administration of those sections of the Federal Social Security Act covering maternal and child health services, crippled children's services, and child welfare services. More recently, it was given responsibility for the administration of the emergency maternity and infant care program, a wartime measure enacted by Congress for providing help and medical care to wives and infants of enlisted men.

It seems appropriate, therefore, for the Children's Bureau to be concerned with any national planning designed to extend and improve health services for the nation's children.

Since 1914, the Children's Bureau has consistently sought advice and counsel from leading pediatricians in carrying out its functions. In fact, much of the credit for the progressive steps which have been taken by the Children's Bureau during the past thirty years can be attributed to the wisdom and vision of the many eminent pediatricians and obstetricians who have served the Bureau in an advisory and consultant capacity during this period.

Present conditions of child life in the United States, although superior to those in many countries, still leave much to be desired. Thousands of American children do not receive the amount or quality of health and medical services which they should receive in order to be assured even a minimum of health.

The importance of safeguarding the health of our nation's children cannot be overestimated. They represent our single greatest national asset and the hope of a peaceful world. This nation has the technical and the financial resources, if properly mobilized, to assure adequate health facilities and services for every American child. This requires planning and joint cooperative action by all communities, state and national groups concerned with the health and welfare of children. No one agency, organization, or professional group can assume full responsibility for such over-all planning. Public and private agencies, professional groups and lay groups must each play a part in developing the plan based solely upon the needs of children.

Many individuals believe that such a plan of action, to be effective, should not be submerged in a national compulsory health insurance system, but should be designed to meet the special needs of children. Many others believe that to finance medical care for children, partly through compulsory insurance is better, since it would provide for them the right to care that is inherent in such an insurance system and that supplementation of insurance funds with general surtax funds would assure coverage of those who wish to participate, noninsured as well as insured, and provide for the special services needed by children.

The first of these two concepts that I have mentioned here is exemplified in the Pepper Bill, the Maternal and Child Welfare Act of 1945, which was based upon recommendations of the National Commission on Children in Wartime. The latter idea is exemplified in S. 1606, which is the Wagner Bill, and the one that is up now for hearings before Senator Murray's committee.

We have in this country the knowledge and the resources to develop a comprehensive plan of action to meet the needs of children. What we need now is intelligent, cooperative national planning. The Children's Bureau is willing and glad to participate in such planning and to continue to carry out the mandate given it by Congress more than thirty years ago.

DR. E. H. COFFEY: It is a privilege for me to be here this morning as a representative of the United States Public Health Service. I say that with considerable pride. I have a feeling—and I feel justified in having a feeling—that the Public Health Service has played a very important part in improving child health of the nation. To be a part of the panel for planning for continued improvement of child health, it goes without saying that we are happy to have a part in such a discussion.

Before the turn of the twentieth century, we were given the responsibility by Congress of cooperating with the states in improving the state and local health services. That responsibility connoted, if you please, that the definite and direct responsibility rested with the local community or the state, that our job was to assist these communities and these states in meeting their responsibilities.

Throughout the years, we have adhered to that policy. Our practice has been always to cooperate with the state and local health departments, and in no sense usurp their prerogatives. Through some one hundred fifty or sixty years that the Public Health Service has functioned, there has been only one or two instances when we have had to step in and take over the responsibility of a local health department in a local area. Those were situations back perhaps a hundred years ago, when we had our epidemics of plague and yellow fever. Not since the time when we had great plagues in our nation has the Public Health Service felt it necessary to interfere in local health problems.

I say that to emphasize this one point, that with the number 2 item in the A. M. A. program—number 2, if you remember, is the recognition of the need for adequate health services throughout the nation. Now, we in the Public Health Service for a long time have recognized that need, and we have been working toward the goal of one hundred per cent representation or one hundred per cent coverage of local departments. Unfortunately, we have not attained that goal. Recent studies have disclosed that large areas in the United States are now still without the services of adequate local health departments.

Now, I am sure all of you will agree that no worth-while plan for improving child health can be evolved that does not give particular and specific attention to improving the over-all health services for the community; certainly, for the provision of full-time health service, so that environmental sanitation may be given consideration and control, so that the foodstuffs and milk supplies going to the population will be properly protected, so that communicable diseases will be under control, and so that the outstanding conditions or the more or less prevalent conditions, almost bearing upon epidemic proportions, can be given urgent attention.

Now, I do not desire, of course, to get into a controversy as to just what can be done in the development of full-time health services. However, I speak with considerable feeling this morning when I say that unfortunately, while we have had more or less lip service from the organized medical profession, and while we have had more or less acceptance of the principles that health departments were essential and necessary, we certainly have not had active support and cooperation on the part of the medical profession in bringing about this objective.

Now, when I say that, please understand that I recognize that in every single community of the United States today there are individuals who have gone all out to back up and to support full-time health departments. What I am speaking about is the organized effort of the medical profession—and I am sure that there is not a person in this room today who will not recognize and will not say that if the organized medical profession, on a community level, would get behind and actively support the inauguration of a full-time health service for their area or for their community, that that health department would come about this soon! At the snap of a finger.

After all, who should the people turn to in a community for leadership in the development of health services other than the medical profession? After all, who should the people listen to when the medical profession takes a more or less hands off attitude in the development of a local health service? Or whom should they be guided by?

I wish to throw this challenge today, as a part of this panel discussion, the challenge that where we have an area that does not have adequate full-time health services, the responsibility rests entirely upon the lackadaisicalness, we might say, of the medical profession, and I hope that the American Medical Association, in its national program, will give it the utmost attention, to develop that phase of their program—not merely word recognition, but active participation in bringing it about.

I have the feeling—and I think a good many of us in the Public Health Service have the feeling—that if today we had one hundred per cent coverage of our nation with full-time, adequately-trained, professionally-qualified public health personnel, that many of the controversies that are confronting us today, from the standpoint of the lapse or lack of medical care, and so forth, would not be present.

Now, so much for that. Without question, we can meet all of these problems. It would make a travesty of our democracy if we felt that they could not be met. And surely, the

governmental agencies, representing the people in the health field, have the responsibility and must lean upon the medical profession for guidance in meeting these problems. So as we go on now in our peacetime activities, forgetting the war, or problems confronted by the war, we are going to have to do a good bit like the United Nations Organization is doing today. We are going to have to overcome many obstacles, but we are going to have to continue to strive for that goal that we know will eventually come about—and that is the best of health for all the people in the nation. Thank you very much!

DR. JOSEPH S. WALL.—I have been asked to speak on behalf of the Academy of Pediatrics in relation to this subject. This discussion on cooperative efforts in national planning for improving child health services was conceived and prepared to present to the members of the Academy for their thoughtful consideration of problems of imminent importance which should not only command their interest, but enlist their aid in solution.

It was intended to be informative, through the presentation from authoritative sources of the role of participation in cooperative endeavor of four most important groups, governmental and medical, whose interests lie in the same sphere, whose objectives are mutually intertwined in official and civilian endeavor and whose activities should be, no doubt can be, cemented in an harmonious whole by considered discussion with resultant collective agreement.

It is fervently to be hoped that in the months to come, private iniative with governmental assistance to supply certain needs, where need is demonstrated, may fairly and adequately provide health services to the ultimate satisfaction of all concerned. Such provisions for better medical care for children, as well as for the adults of our nation, must possess the attributes of justice and equity to each of the segments of the population involved, whether they be the recipients of medical services, the ministers through whom such services are rendered, or the tax-paying public, who must be called upon in no small measure to provide funds through the public purse in cases of need.

To possess this needed and basic element of justice and equity, future medical planning should be formulated only after conference between all three members of the triumvirate named, for unilateral action, planned or put into actual operation by one single component of the triangle might possess the potentiality of such injuries and disharmonies to the other groups, that disaster would ultimately be the only outcome. Such directful results can much better be avoided by anticipation, rather than receive belated rectification in retrospect.

In relation to child health, pediatricians may point with satisfaction to the benefits which have accrued in the past from the various authoritative White House Conferences initiated in 1930, in which many of our members participated. Why could not a similar series of congresses or conferences to secure a meeting of minds be instituted in the immediate future?

Recent trends have indicated that a national health conference has an appeal which is receiving wider and greater support with each passing month. Even our limited effort of this morning's session is but a straw in the wind which reveals a growing current of belief in the wisdom of conferences and exchange of opinion concerning health planning. Many of our own beliefs will be crystallized after the report of the Academy's Committee on Child Health Services now engaged in an extensive study of which you will hear more later in the morning.

The Academy of Pediatrics, to the best of my knowledge, is the only medical organization which has had for many years a "standing committee" on cooperation with governmental and medical agencies, under the auspices of which this discussion is being conducted.

The committee consists not only of Academy Fellows, but in cooperative association includes official representatives appointed by the American Medical Association, the Children's Bureau of the United States Department of Labor, and by the United States Public Health Service, who are intimately concerned in the problems which engage our own attention.

The Academy itself has always pled for cooperation with all whose interests are concerned with children. To such has the Academy's aid ever been freely proffered and usually well received.

At its last meeting in Detroit, the Academy reiterated its eagerness to join in conference with those responsible for certain contemplated planning affecting the medical care of children. After lengthy discussion of pending congressional legislation, a resolution was unanimously adopted which reads as follows:

The American Academy of Pediatrics in annual session at Detroit, Michigan, January 15-18, 1946, after careful consideration of proposed legislation in Congress as it relates to child health services reaffirms its resolution as adopted at its 1939 session, namely:

> That the American Academy of Pediatrics, regarding the provisions for maternal and child welfare, favors the use of public funds to provide *such services to those groups of the population unable to pay for medical services*, to the end that the standards of medical care may be maintained at a high level among such groups.
>
> The Academy of Pediatrics does not favor the use of Federal funds for those able to provide good medical care from their own resources.
>
> The Academy directs the attention of those considering proposed legislation to its fact-finding study of child health services now in progress which, at its conclusion, should assist in the development of sound programs at state levels based on demonstrated needs.
>
> Pending the completion of this study, it is recognized that urgent needs exist in some states that should be met in the immediate future. To this end, the Academy recommends that additional Federal Funds be made available for grants-in-aid to states under existing maternal and child health and crippled children's programs of Title V of the Social Security Act as amended in 1939.
>
> The Academy would welcome the privilege of sending Representatives now or at any time to confer with those responsible for the preparation of legislation pertaining to child health.

The House of Delegates of the American Medical Association at its December meeting adopted a resolution proposing the formation of a Health Congress, although of rather limited scope, to consist of representatives of the medical, dental, hospital, nursing, pharmaceutical and allied professions, and that it approves the creation of such a coordinating body.

The functions of this proposed Congress are also limited "to undertake to bring to all the people of this nation the complete benefits of modern medical-dental science and the finest hospital facilities, to arrange for budgeting the cost of such services at monthly rates within the financial means of all Americans through voluntary, nonprofit health plans and to work speedily for the institution of such voluntary nonprofit health plans in those places or localities where they do not exist now."

In a similar but much wider vein, the Michigan Medical Society proposes a National Health Conference, with a membership made up of a representative or representatives of each state hospital association, state medical association, state nursing association, state pharmaceutical association, the industry of each state, the labor of each state, the agriculture of each state, a representative of the United States Senate, the House of Representatives, and the United States Public Health Service.

At the meeting in December of the House of Delegates of the American Medical Association, the New Jersey delegation presented resolutions on a Permanent Conference on Medical Care "to be created immediately either by (1) the American Medical Association, (2) the Congress of the United States, or (3) the President of the United States, to be composed of an equal number of representatives of (1) the American Medical Association and (2) the governmental agencies concerned with health services and that the members of such conference be given equal powers of action to the end that the American people may be provided in our time with the best possible quality, quantity, availability and distribution of medical care by concerted American democratic action with resultant peaceful solution of the medical care problems which concern us all."

Perhaps, somewhere among the proposals named there may be found a magnetic field into which the good elements of all might be drawn so that such a congress of workable size could be brought into being to effect a program of health to which all parties having interest therein may subscribe in the cause of harmony, equity, and ultimate success.

Agriculture, industry, labor, business, and members of professions of education, law, and religion, forming what we call the public, have an inherent interest in health planning. These great groups which eagerly seek the advantages of health are not equipped with a knowledge of medicine nor of medical technics by means of which the desideratum of living in health and well-being may be secured. That's why doctors were born!

It is not unreasonable to assume, therefore, that the guidance of physicians should occupy an important, if not the most important position in national health planning. That they have been denied such an authoritative voice, in past and future planning, is a matter of record.

Some of our elder members may have studied medicine, as I did, from textbooks titled "The Theory and Practice of Medicine." Sociomedical legislation is too frequently based upon the views and aims of politically-minded legislators, of administrators and even of a small group of physicians who may be versed more or less widely in the "theory" but not in the practicalities of the "practice" of medicine, although the latter is the only medium through which medical care can be successfully extended to individuals.

Should we not in child health planning have better teamwork? Might we not learn some helpful lessons in team play from the methods of those who indulge in the national pastime of football?

To succeed, the linesmen should be those of sturdy intelligence, representing agriculture, industry, labor, business, and the like. In the backfield are the two halfbacks of the Public Health Service and the Children's Bureau, with a highly important figure, the Academy of Pediatrics, as quarterback, who calls the signals because he knows the game and the strategy of play. The general practitioner who engages in pediatrics is the alert rear guard in the position of fullback.

"Huddles" should be indulged in frequently in the interest of coordination, upon which the winning of the fray depends. Who are our opponents? They have been well named by the late L. Emmett Holt, Sr., as the forces of "poverty, ignorance and neglect." To conquer them, there is needed the closest teamwork, with a backfield incurring no penalty because it is constantly in motion, but with each and every member of the team spurred with the ambition to quickly reach the goal of success.

Since the writing of the above on Cooperative National Planning for Improving Child Health Services, an encouraging change of mind has been witnessed among the solons of legislation in the Congress who have issued a communique quite in keeping with the intent and purpose of this morning's discussion.

A letter has been addressed to the "leading professional organizations in the field of health and medical care," including our own Academy, actually requesting something unique in the history of governmental health planning, but a proposal equally to be desired and embraced. The letter reads as follows:

UNITED STATES SENATE

Committee on
Education and Labor

There are now pending before the Senate Committee on Education and Labor many legislative proposals as to specific methods of promoting improved health. In considering these proposals, however, it would be a mistake to focus attention entirely upon methods. The time has come, I believe, to ask, "What are our objectives on the nation's health?"

Accordingly, on behalf of the committee, I am writing to the leading professional organizations in the field of health and medical care to ask that they join in a cooperative attempt to stake out specific health goals for the coming five years. I am sure that your organization will be anxious to cooperate in this endeavor.

The enclosed outline sets forth a comprehensive framework for a statement of America's health goals. Some groups will feel qualified to suggest goals for every item; in fact even to add subjects not referred to in the list. Others will want to

confine themselves to specific subjects within their field of experience and competence. Still others will prefer, in some instances, to set forth their goals in terms not only of a five-year period, but also for a ten-year period—in order to indicate the progress that can be made over a longer span of time.

It is obvious, of course, that setting quantitative goals—such as reducing the incidence of a given disease by 50 per cent or raising the number of dentists from 70,000 to a higher figure—does not imply a forecast or prediction of what will actually happen. Setting a goal merely indicates what we should aim at and what we can achieve if we fully mobilize our health resources and take full advantage of the rapid progress that is being made in the arts of prevention, diagnosis and care.

If your organization is presenting a statement to the Committee on the National Health Bill, S. 1606, hearings on which will be held during April, your suggestions for health goals might well be presented at the same time. In any case, the Committee's work on this matter would be greatly facilitated if we could hear from you by the end of April. If this provides insufficient time for final judgment, let me assure you that your preliminary and tentative estimates will nevertheless be greatly appreciated.

I should like to reiterate that this survey is limited to a discussion of goals and does not involve any questions as to alternative methods of achieving a specific goal.

Finally, let me express my confidence that the entire health profession will enthusiastically join in this endeavor and produce a set of health goals fully consistent with the hopes and aims of our American democracy.

Sincerely yours,

JAMES E. MURRAY

Chairman
Education and Labor Committee

Questions on

*Health Goals for America's Future*

1. Over the next 5 years, what should be our goals on the nation's health?
   What should our aims be with respect to increasing the average expectation of life?
   What should our aims be in reducing—
   a. the infant mortality rate?
   b. the maternal mortality rate?
   c. the death rate at various ages?
   What should our aims be in preventing or controlling—
   a. heart disease?
   b. cerebral paralysis?
   c. cancer?
   d. tuberculosis?
   e. diabetes?
   f. pneumonia?
   g. poliomyelitis?
   h. rheumatism and arthritis?
   i. rheumatic fever?
   j. venereal disease?
   k. malaria?
   l. dental defects?
   m. defects of vision?
   n. defects of hearing?
   o. mental ill health?

2. Over the next five years, what should be our goals on health personnel, facilities and education?

What should our aims be with respect to the number and distribution of qualified—

a. doctors?
b. dentists?
c. nurses?

What should our aims be with respect to the number and distribution of adequate—

a. hospitals and hospital beds?
b. health clinics and health centers?
c. sanitation facilities?

What should be our aims be with respect to—

a. medical research?
b. professional medical educational?
c. health education for the public?

Although the letter asks for "suggestions for health goals," it also contains a rather disquieting reservation to the effect that "this survey is limited to the discussion of goals and does not involve any questions as to alternative methods of achieving a specific goal," a statement which physicians would view as resembling diagnosis alone, without its desirable companion of indicated treatment.

This letter appears over the signature of the Honorable James E. Murray, Chairman of the Senate Committee on Education and Labor, who is in charge of the hearings now in progress on S. 1606, which bears his name as a cosponsor, the Wagner-Murray-Dingell Bill.

## DISCUSSION

CHAIRMAN WALL.—We regret that time is not available to have discussion from the floor, but we thought perhaps that the panel members might wish to discuss some points among them. We have just heard that Dr. Van Horn wants to ask a question. We will ask Dr. Van Horn to state his question.

DR. VAN HORN.—I would like to give one bit of information and also ask a question of Dr. Bauer. You will recall that Dr. Wall has made some reference to the action taken by the Academy at the Detroit meeting, with reference to certain recommendations in seeking additional funds, under the provisions of the Social Security Act. That has been explored with the Congress, and we have been informed that the act will be open, and that we will be given an opportunity for a hearing in order to obtain additional Federal funds under the present provisions of the Social Security Act, to provide for extension of the maternal and child health and crippled children's program.

There is a question I would like to direct to Dr. Bauer, if I may. In one of the stands of the National Health Program of the American Medical Association, I believe it is under Item 2, Dr. Bauer, reference is made, that the Health Department should not assume the care of the sick as a function. What I would like to ask is, does this mean that health departments which administer medical care programs, such as tuberculosis control, venereal disease control, services for crippled children and children with rheumatic fever and heart diseases, should they abandon such programs?

DR. BAUER.—The provision in that particular item of the program, Dr. Van Horn, related to medical care in general. I think tuberculosis, venereal disease, and some of the other things you mention are more or less, we may say, taken out of the general medical care program, and it was not related to them.

If I may, Dr. Wall, while I am on my feet, there are one or two remarks I would like to make with reference to some of the other things that were said. Dr. Coffey said that the organized medical profession had given lip service only to the extension of public health services. I think that is not quite an accurate statement. The American Medical Association

has urgently fostered the extension of public health services for years. It has been part of every program of which I have knowledge for a good many years.

In fact, if he looks back in the history of the United States Public Health Service itself, he will find the United States Public Health Service was sponsored by the American Medical Association.

I can cite an instance in my own county. We had no full-time health department in Nassau County, L. I., until, I think it is approximately seven or eight years—it may be ten. We would now still have no health department in Nassau County if it had not been for the Nassau County Medical Society. That society was directly responsible for the establishment of a full-time health department in Nassau County, and one which is, I may say, as well administered and free from political control as any health department anyone can mention.

We had the same trouble about a hospital for the indigent in Nassau County. We had only one indigent ward in the county hospital, and for nearly fifteen or eighteen years, the county medical society urged the establishment of such a hospital and met with nothing but opposition from the political authorities, as they did in the case of the health department, and finally the county society went to bat on it and insisted it be taken through a referendum vote of the population, and they voted for it and we got it.

These are two instances which serve as illustrations.

I will admit there are some county societies that are not very active, and one of the items to which I did not pay any attention in my discussion before is that the A. M. A. is urging a reactivation of these county societies to make a living force for progress in their communities.

One other item I neglected to mention in connection with the national conferences, there has just been held a conference on rural health, a national conference on rural health, by the A. M. A., just this last Friday and Saturday in Chicago, so I have not yet heard the results of it, but we have a very active committee on rural health and as you know, the rural health problem is one of the most important ones which we have, and that committee, which is under the leadership of Dr. Crockett, of Indiana, made tremendous strides in solving the problems of rural health, and they are getting cooperation and active cooperation of the various farm organizations, in helping solve it.

Dr. Van Horn, I think it was, who said we need intelligent, cooperative national planning. I second that most heartily. The only way we can get it is for everyone to sit down as we have here today and listen to the other fellow's viewpoint, and then let us argue in a friendly fashion, and if we think the other man is wrong, let us try to show him where he is wrong. If we are wrong, let us be willing to hear the other man's side of it, and see if perhaps we cannot get together—at least in ninety per cent of our aims.

We all want the same thing. It is a question of how we are going to obtain it. My feeling is that compulsory insurance bills, exemplified particularly in the Wagner-Murray-Dingell Bill, do not represent ideal cooperative planning. I do not think it is particularly ideal, and I am most certain it is not cooperative. It reminds me of when I was about fifteen; I belonged to a club. We were organized for a year. Another group organized a club and adopted our name. We did not like that much. We had a group from each club get together to see if we could not iron it out. We called attention to the fact that we had had the name longer than they had. Their reply was, "We'll compromise. We'll keep the name, and you can take any name you want."

CHAIRMAN WALL.—We'll ask Dr. Coffey if he cares to make an answer to the question.

DR. COFFEY.—Thank you. I am glad Dr. Bauer brought up that specific situation that I pointed to. True it is, medical societies have had a part in organizing health services. I think it only emphasizes my point, that if organized medicine wholeheartedly and actively got behind the development of full-time health services, we would have full-time health services throughout the nation. We would have them today if in the past they had gotten behind them, because the communities will accept the leadership of the medical profession, thank goodness, and by accepting that leadership, they will follow their recommendations.

But I could not have been in public health administration work for twenty-two years, have worked in every section of the country and have been working toward the development of local full-time health departments without recognizing, without making comment upon the fact that it is because of the lack of action on the part of the medical societies that we do not have one hundred per cent coverage of full-time health services. Too often the position that is taken by the medical societies is, "It is only a step toward socialized medicine." Some place we must draw the line between what is public health and what is socialized medicine, and certainly, in a democracy we must accept—or in any government, for that matter—the responsibility of the government for protecting the health of the people.

Now, I would like to ask Dr. Bauer a question—it is somewhat pertinent to the one Dr. Van Horn brought up. The suggestion was that health departments should not engage in the practice of rendering medical care to individuals. Some place in the A. M. A. program, it does provide for official funds to be used in defraying the expenses of the indigent person. Now, I would like to ask Dr. Bauer what agency of the government should administer those funds, recognizing that if government funds are used, surely some governmental agency would have to be responsible to see that they are expended wisely and effectively.

I am wondering whether Dr. Bauer will tell us that there is any other agency of the government, Federal, state or local, that is better prepared to administer that phase of the program than the health department, recognizing that the health department at least is under the guidance of professional medical men, and at least would be familiar with and recognize the problems at hand.

DR. BAUER.—Medical care to those unable to provide for themselves is best administered by local and private agencies, with the aid of public funds when needed. This program for national health should include the administration of medical care, including hospitalization to all needing it and unable to pay, such care to be provided preferably by a physician of the patient's choice, with funds provided by local agencies, with the assistance of Federal funds when necessary.

Usually, in every community, local organization, either private or maybe public—this refers particularly to Federal administration of medical care, and my own county, we have provisions for caring for the indigent and in this state also there are provisions for the care of the indigent through the Department of Public Welfare of the state, and in this state, the patient does have the right of choice of his own physician. The State Board of Welfare together with the county jointly pay the bill.

DR. COFFEY.—Dr. Bauer said in this state the people, the indigent, are given medical care by the Department of Welfare. I would like to ask specificially, does he recommend welfare departments do such administration of the indigent medical care as is necessary as versus the health department?

DR. BAUER.—I think the care should be administered by the physician. Now, if the care is to be administered by the patient's own physician, I do not think that it makes much difference whether it is the health department or the welfare department that pays for it. I think as far as possible, it should be left on an individual basis.

DR. VAN HORN.—As long as we are all directing questions to Dr. Bauer, I wonder if I may ask another one, Dr. Bauer. A statement is made in the National Health Program that implies a rather sharp distinction between preventive medical services and curative medical services. It is rather difficult, for pediatricians particularly, to understand such a sharp distinction. I think in pediatric practice, one practices one thing one minute and the other thing the next, and there isn't any clear-cut line. I wonder if under the National Health Program, as you visualize it, one agency might be given responsibility for preventive health services, as you have indicated for health departments, and another group will provide the curative services.

DR. BAUER.—I am used to having all these questions thrown at me; it is nothing new. Preventive medical service, I think, covers a lot more than actual preventive medicine through medication. It covers health service, prevention of disease through, as one of these

gentlemen mentioned, the care of the environmental factors, such as sewage disposal, care of the water and milk and food supplies, and mosquito and fly control. That certainly is preventive medicine, but it is something that has to be done by a governmental agency. The individual cannot do that. All these things involve the employment of the police power, and the individual physician does not have police authority. That must come through a governmental agency.

Then, of course, we can go down to the more individual items, such as inoculation against smallpox and diphtheria, and so on, and there again the material should be available through the state health department for individual physicians to give, and if there is no arrangement by which that can be done, as in the case of the indigent, I think the health department would have to make arrangements to give it.

I do not think that it necessarily involves curative medicine in taking care of any of those particular items.

CHAIRMAN WALL.—Any questions on the other side?

DR. NICHOLS.—I have one question to ask Dr. Van Horn on this cooperative story, and I would like to quote, before I ask him the question, for his information, from the Catholic University Book, "Better Times." It says this: "Lasting social reforms can only be accomplished through voluntary cooperation. As a consequence, the state should stimulate its citizens to find a solution of their own problems through free cooperation, and not under any compulsion. A democracy loses its soul when it loses faith in itself and becomes impatient of the democratic progress."

I would like to ask Dr. Van Horn, in accordance with our Academy resolution at Detroit, which favors the use of public funds to provide child health service to those families unable to properly provide good medical care from their own resources, should we not now jointly, Academy, A. M. A., Public Health Service, and Children's Bureau, select this area of agreement that we are all agreed upon and study and promote at state level, and later national level, operating plans, such as the Maryland State Medical Plan, the Newark, New Jersey, Medical Plan, which is now providing good medical care for this group unable to provide this service from their own resources, and study similar plans?

DR. VAN HORN.—I certainly think we should all get together and discuss the problem. I think, of course, it is really the most important problem, the most controversial one in the whole question of providing medical care—that is, the determination of the means test.

There are many people in this country who feel in any medical care program there should be no provision for a means test. I think I can say that as a representative of the Children's Bureau, we certainly would frown upon the idea of subjecting every individual to a searching question as to their financial ability to meet any cost of medical care. I think that that is something that would have to be ironed out, and I don't know as we could come to any agreement on it today, Dr. Nichols, but certainly, I am in hearty accord with the idea of all getting together and sitting down and working out something that is practicable and workable, and that we all agree on.

CHAIRMAN WALL.—I am afraid that time will not permit further discussion, interpanel discussion, but I want all the members in the audience to realize they have the right to buttonhole the members of this panel as they go out and ask any questions they want to.

I want to thank, on behalf of the Academy, those who have consented to take part in this discussion.

# The Academy Study of Child Health Services

The rapid growth which the Study of Child Health Services has undergone in the last few months is best illustrated by the contrast shown in the two progress maps for April and July included below. The marked decrease in "white space" in the July map is proof of the zeal and effort with which the state chairmen, executive secretaries, and their associates have carried out the numerous details of the study.

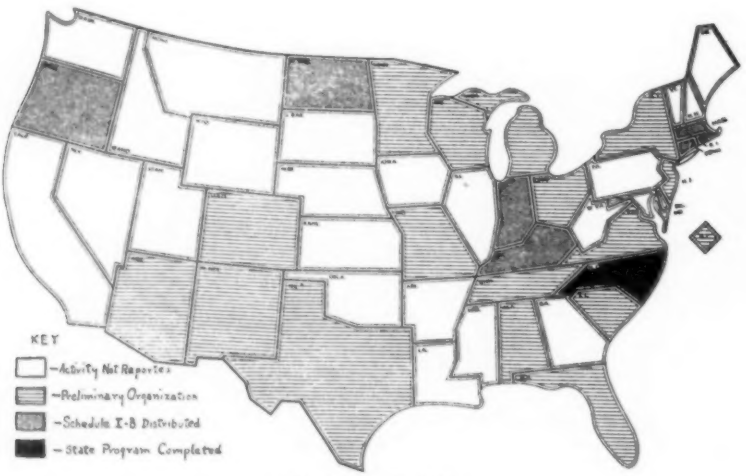


Fig. 1.—April, 1946.

Fig. 2.—July, 1946.

SCHEDULE DISTRIBUTION

With the preliminary details of organization completed, the arduous process of schedule distribution has begun in the majority of states. Twenty-three states report the distribution of one or more schedules as of June 15. Of the three series of schedules in use, Series I—concerning hospitals and related institutions—involves certain variations of distribution depending on the progress of the Commission on Hospital Care Program. Wherever possible, the Academy Study has been correlated with that of the Hospital Commission. Through the cooperation of the Commission, information on general and pediatric hospitals is being collected in nineteen States. By reason of the difference in timing of the two studies, a special form (schedule I-A) is being used in twenty-eight States not covered by the Hospital Commission. In three States information is being collected by both the State Study program and the Hospital Commission. The remaining schedules of series I on special hospitals have been distributed in fourteen States.

Collection of data pertaining to public and private health organizations (series II) is now under way in thirteen States, with eight States reporting complete distribution of these schedules as of June 15.

Questionnaires for pediatricians, general practitioners, and dentists (series III) have been sent out in nineteen states, and all professional personnel in private practice have been reached in eight of these states.

Preliminary reports of returns of the completed questionnaire are most encouraging. Fourteen states have received completed schedules, and one executive secretary reports that his records show a 90 per cent return from the pediatricians of his state and a 66 per cent return from the general practitioners to date. Since the percentage returns of the completed questionnaires represent the most important part of the study, it is to be hoped that subsequent records will show even greater cooperation on the part of those being asked to supply the necessary information.

PERSONNEL

Exclusive of committee members and clerical assistants in the state offices, 131 persons are now actively engaged in the conduct of the Study of Child Health Services. This figure includes 56 state chairmen, 1 regional director, 51 state directors, executive secretaries and assistants, and 23 staff members in the Central Office. As of July 1, only six states and the Territory of Hawaii have been unable to secure executive secretaries. It is of interest to note that of the total 49 executive secretaries and assistants, 31 are physicians, of whom 29 are pediatricians; 2 are senior medical students, and the remaining 16 represent a variety of backgrounds including social work, nursing, business, Red Cross, and health and welfare activities.

SPECIAL FALL MEETINGS

In anticipation of the final stages of the Study when tabular information is to be returned to the states for future study and planning, a special series of regional meeting is now under consideration. In order to "sound out" the opinions of those most closely connected with the individual state programs, the following letter has been sent out to all state chairmen and executive secretaries for the purpose of determining their reactions to the proposed schedule of activities:

June 25, 1946

*Important*

Despite the fact that you have been deluged with material from our office, I sincerely hope that you will give this letter your earnest and prompt consideration.

When our Study was first developed it was intended that the material gathered throughout the States should be presented in an over-all factual report from our Central Office. This will, of course, be done, but it has become increasingly apparent that a report from our Central Office is only a part of the job and that of equal, or perhaps greater, importance is the need for a report to be made at the State level.

To provide the basic data upon which these State reports may be made, we have promised to return to State groups tabular material for each State broken down to the level of counties and cities of 10,000 or more population. There has been considerable discussion in our office of the amount and nature of the material which should be returned to the States and the extent to which this material should be accompanied by a descriptive text. In other words, should we return to the States merely the tabulated material, or should we attempt to outline the type of report that might be written? I feel sure that the answers to these important questions will vary in different parts of the country and that the State Chairmen and the Executive Secretaries who are actually involved in the conduct of the State programs are the ones best qualified to give the answers.

Meetings have therefore been planned in order to allow opportunity for full discussion of this question between those who have been active in the Study at the State level and members of the Central Executive Staff. We are anxious that these meetings should be held at as early a date as can suitably be arranged. However, with summer holidays now approaching it is unlikely that satisfactory meetings could be held before the Fall. For several reasons it appears undesirable to let this matter wait until the meeting of the Academy in November. By November it will have been necessary to crystallize some of the procedures for the analyses and State tabulations. Also, it is likely that in the early Fall several of our Executive Secretaries will have completed their work and be leaving.

In order that the Central Staff may have an opportunity to obtain the opinions of all those who have been conducting the Study throughout the States, it is planned to have three Regional Meetings rather than one over-all meeting. These Regional Meetings do not adhere to the Regional Divisions of the Academy but have been arranged from the point of view of approximately equal division of the country and geographical convenience.

A meeting has been planned in Chicago, at the Palmer House, on September 13 and 14, to include the following nineteen States:

| | | |
|---|---|---|
| North Dakota | Iowa | Michigan |
| South Dakota | Missouri | Indiana |
| Nebraska | Arkansas | Ohio |
| Kansas | Louisiana | Kentucky |
| Oklahoma | Wisconsin | Tennessee |
| Minnesota | Illinois | Mississippi |
| | | Alabama |

A meeting has been planned in San Francisco (hotel not yet confirmed), on September 17 and 18, to include the following 12 States and the Territory of Hawaii:

| | | |
|---|---|---|
| Washington | Nevada | Arizona |
| Oregon | Montana | New Mexico |
| California | Wyoming | Colorado |
| Idaho | Utah | Texas |

A third meeting has been planned for September 30 and October 1 at the Mayflower Hotel, Washington, D. C., to include the following 17 States and the District of Columbia:

| | | |
|---|---|---|
| Maine | New York | Virginia |
| New Hampshire | New Jersey | North Carolina |
| Vermont | Pennsylvania | South Carolina |
| Massachusetts | Delaware | Georgia |
| Rhode Island | Maryland | Florida |
| Connecticut | West Virginia | |

In order that we may further develop our plans for these meetings, I will appreciate hearing from you as soon as possible whether or not you can attend. Also I shall appreciate receiving any thoughts you may have on the type of discussion which is desired. One suggestion which has been made is that State Chairmen and Executive Secretaries should meet with representative persons or groups from the State Medical Societies, State Health Departments, and their own Advisory Committees prior to these meetings in order to be able to represent as fully as possible the opinions and attitudes of all those concerned in the Study.

The expenses of State Chairmen and Executive Secretaries for attending these meetings should be met from the State Budgets.

Sincerely yours,

JOHN P. HUBBARD, M.D.

# The Social Aspects of Medicine

Several months ago the following three questions were sent to fifteen members of the Academy representing various opinions in their social thinking.

1. If Federal funds are made available to expand health services and medical care for children, how should they be administered by the Federal agency, by the states and localities?

2. What should be the composition and function of an advisory committee to each type of agency?

3. Should technical advisory committees be separated from general advisory committees that include representatives of the public and the professions?

Nine replied. The answers are as follows—

Dear Dr. Park:

In answer to your questions I should say—

1. a. Federally, probably through the Children's Bureau.

b. By the states, through the medical schools, or where none available, or it is not desirable, through the State Board of Health.

c. By the localities, through the local society in co-ordination with the county health bureau.

2. It seems to me that too many cooks will spoil the soup. The responsibility should be chiefly invested in each state, with something of a competitive spirit and due credit given for progress shown. The committee should be purely advisory and should be composed of Academy members only. Each state Pediatric Society should elect their advisory committee on this work.

3. I do not thoroughly understand this question. I have always felt that it is wise to include the public in committees that are getting health work done. A great deal of stimulation and aid in actual work can be secured in this manner.

I would appreciate any further information that you have under question 3, and look forward with great interest to how your analysis of the reports on these questions turns out.

Sincerely yours,

H. F. Garrison, Jr., M.D.

Jackson, Mississippi.

Dear Dr. Park:

In answer to your questions I should say—

1. If Federal funds are made available to expand health services and medical care for children, the Federal agency to administer the funds, in my opinion, is the Children's Bureau. In Wyoming I served two years as director of maternal and child health and of crippled children. The agency, at the State level, to administer the funds should be the Health Department. This could be much improved in our State, and doubtless in the future will be improved. Locally, the county health officers should administer the funds, though at first, in the counties where there are inadequate health officers, this will not be satisfactory.

2. The advisory committee should be made up of representatives of organizations which have the welfare of children at heart: P. T. A., schools, women's clubs, American Association of University Women, American Legion, ministers, doctors, and dentists.

The function of the committee should be the initiation of reforms, and the support of programs such as the immunization of preschool children, the proper examination of school children with particular attention to problems of nutrition, dentistry, hearing and visual

defects, good posture including good feet, the detection of hernias, and their repair, and mental hygiene. I was on the board of doctors who helped in the induction of men into the Armed Services, and I was depressed by the number of hernias which should have been detected years before. The community in general should be represented, for as it is now, the doctors and dentists are afraid that their incomes will be cut down and discourage anything which seems to threaten their practices. This is natural, but I think it would be reassuring for the doctors to confer with men and women who see the problem from the point of view of the public at large, which includes poor people who are not receiving adequate care.

3. The advisory committee should have representatives from both the people and the professions, with provision for regular meetings of the groups, together and separately.

Sincerely,
PAUL W. EMERSON, M.D.

Cheyenne, Wyoming.

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Dear Dr. Park:

It would seem to me that your first question could hardly be answered in the negative, since with state and local administration a more sensitive machinery is employed. In this way the local needs are more closely met and any criticism is more easily applied to responsible authorities. It seems to me that the criticism felt toward the Children's Bureau is due to its remote control and its inability to establish a general plan that suits individual conditions.

Your second question is more difficult but I would think that the executive secretaries of the various child caring agencies would form the basis of such a committee with interested pediatricians.

I see no reason for a separation of the technical advisory committee being made; they could, of course, have their meetings, if necessary, and report to the general board for discussion.

We have so much confidence in the ability and sincerity of our State and local Boards of Health that we would be much more cooperative with their efforts than with a Federal agency.

With kindest regards, I am,

Sincerely yours,
CLIFFORD L. LAMAR, M.D.

Birmingham, Alabama.

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Dear Dr. Park:

I apologize for my delay in answering questions submitted by you some time ago. In answer to question 1, I would favor the over-all policy-making by the Federal administration and the actual operation carried out by the state and localities.

I would think that the advisory committees should be composed of both lay and medical men with professional domination. A representative of the United States Public Health Service and Children's Bureau might well be included.

The technical advisory committee should be separated from the general advisory committee due to their special knowledge and the fact that they would be responsible for the functioning of the organization.

I favor, along with most medical men, a creation of a Cabinet post of health in Washington which, it seems to me, would simplify the correlation of government and private medical care.

I have enjoyed the discussion by you in the recent issues of the JOURNAL OF PEDIATRICS and believe some definite good will be derived from them.

Very sincerely yours,
JOE T. SMITH, M.D.

Knoxville, Tennessee.

My dear Dr. Park:

This is an attempt to answer your questions, but the point of view may obscure the attempt somewhat.

It is my opinion that the time is at hand, or should be shortly, for representatives from the three major health agencies dealing with children, namely, private pediatricians, Public Health services, and the Children's Bureau, to sit down in conference and define the spheres of influence of these agencies. At the periphery of these spheres there will be overlapping problems, new and old. To act upon these problems, there should be a standing technical committee consisting of professional people from each group.

There are health problems best handled at a local level, others at a state level, and still others at a national level, and the funds allocated should be administered by the agency at which level the problem is handled. To illustrate: the problem of the migrant workers who travel from state to state must be solved primarily at a national level, although assignments for administering the care may be made to states and localities. The problem of poliomyelitis, at present on a county level, could be handled better on a state or semistate level. Sparsely populated counties cannot set up and maintain the best modern facilities for its care; it is neither economical nor desirable that they should. Poliomyelitis also illustrates the desirability of defining and delegating problems to the right agency. The Poliomyelitis Fund, a separate and unique fund, has invaded the field covered by the Crippled Children's Act. Questions arise, such as, "Shall children crippled with poliomyelitis and now carried by Crippled Children's funds, be reassigned to poliomyelitis funds?" Poliomyelitis is a reportable disease; shall cases in the acute stage be transferred over county lines? The Poliomyelitis Fund is designed to meet the needs of any individual suffering from the disease; what then becomes the status of the private doctor in relation to the patient? He is not generally paid by the Fund. This disease alone, therefore, brings up questions involving the Children's Bureau, Public Health, and the private physician, and none of these questions has been answered. There is at present no machinery (Technical Committee) to turn these questions over to for solution or recommendation.

Advisory committees should be separate groups concerned not with the "who" but with the "how" of giving the aid to the right children at the right time and in the best possible manner. These committees should consist of representatives from professional and lay organizations of the community which they serve.

Sincerely,

H. E. THELANDER, M.D.

San Francisco, California.

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Dear Dr. Park:

1. *Administration of Federal Funds.*—This is the most difficult of the three questions to answer. The expenditure of public funds at any level necessarily should and does require a strict accounting. I can recall, in my limited experience, no occasion when the politicians' cry of "graft" has arisen in reference to the use of funds for medical purposes. Inevitably, of course, it will, and then such accounting will be the profession's shield and mainstay. Unfortunately, on a Federal level, this accounting requires an amount of "red tape" so cumbersome as actually to interfere, in my opinion, with the efficient administration of a medical program.

I see very little wrong with the present system whereby the several states are allocated funds through the Children's Bureau and account for them through already established administrative channels. The greatest fault I can think of is the tendency of the Bureau to use the "withholding of funds until . . ." mechanism as a club to force state cooperation. an expedient practice but not one calculated to inspire love and affection essential to real, rather than apparent, cooperative endeavor.

The dispersal of funds within the states is the point at which the greatest finesse and administrative skill are required to operate any health or medical program effectively. Probably, elimination of local subdivision and the establishment of administration directly from the state to the individual is the most easily workable plan but this will, of course, vary in different states.

I think that the crux of the matter lies (as always) in the person selected as administrator at the state level. In conducting a health and medical program dealing with children, the state director should be a pediatrician. Furthermore, he should be a pediatrician of the first rank whose skill and judgment command the respect of his fellows. He should also have administrative skill, although I think that experience in administration is perhaps overweighted as a requirement by many Public Health workers today. Such a person is, admittedly, a rare bird. For this reason, he is probably not to be had for the remuneration usually available for medical public officials. In short, a man good enough for the job should be paid at least as much as he might expect to make in private practice or other positions in the field of Pediatrics. This concept will prove a stumbling block almost everywhere, even if funds are available to provide a suitable salary, because of the prevalent low salaries in other medical fields of public service and the inevitable jealousies and squabbles which would follow the creation of a position out of line with similar jobs in the same government. The selection of a capable and strong-minded state administrator would automatically go far toward alleviating the present much-deplored tendency of the Children's Bureau to carry policies and procedures past the state level, their proper end point.

This brings us to the matter of the proper agency from which to administer these funds. So far as the Federal level is concerned, I am in accord with those who believe that all medical and health affairs should be executed by a single agency. Whether such an agency has Cabinet, Bureau, or other status is a matter for the political economists to decide. I think it is impractical to consider administration at the state level by other than the regularly constituted existing health agency. If it is felt that this agency is incapable, steps should be taken to make it effective since I do not feel that the health of children can be completely "compartmentalized" and divorced from the considerations of the general welfare of the people of a state. It is entirely feasible, on the other hand, to alter existing administrative techniques to encompass the enlarged responsibility implied in any such program. One such alteration may and should be the creation of (or the strengthening of one already existing) an advisory committee for the children's program.

2 and 3.—*Advisory Committees.*—First of all, advisory committees, at whatever level, should function. In order to function, I think that a committee should be small in numbers, wide in representation, and superior in composition. This is a roundabout way of indicating that the personality, character, intelligence, and special capabilities of the individual members are paramount. If this is neglected committees will either be impotent or dominated by one or two individuals.

The Federal Agency is, I believe, best served by at least two advisory committees. Foremost should be a committee functioning much as does a Board of Health or the Board of Directors of a Hospital. In determining the composition of this committee, selection might be based on eminence and ability in pertinent special fields as well as general character. If such a national committee included representatives of Pediatrics, Social Service to Children, Finance, Government, Economics, and Public Health, it might be reasonable to utilize individual committee members as consultants on special problems as well as submitting overall policies to the committee as a whole. A second Federal level committee should be purely technical and obviously composed of pediatricians. Even though our pediatric organizations, such as the Academy, have no official status (and this fact should never be forgotten) it is entirely reasonable to depend largely if not entirely upon them to determine the makeup of this technical committee. So far as technical advice from allied fields, such as nursing, dentistry, education, etc., I believe that the liberal use of individual consultants rather than committees is the more effective procedure.

At the state level, one committee, analogous but not necessarily exactly parallel in composition to the National Advisory Committee on policy, should suffice. Its precise composition in each state must depend upon: (1) the nature of the problems peculiar to that state, and (2) the material available for selection. For technical advice, the State Director should rely upon the body best qualified to solve the particular problem at hand and, if he is to be an effective administrator, he should be allowed a maximum freedom of choice. Many problems have satisfactorily ready-made solutions already determined at the Federal level and for those of a purely local nature the advice of the Pediatric representatives on his central committee might reasonably be sought.

In summary I should like to reiterate that the success of any program of child health and medical care hinges, in my opinion, upon the securing of capable administrators at all levels but especially at the state level.

GLIDDEN L. BROOKS, M.D.

Lewiston, Maine.

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Dear Dr. Park:

Before answering the questions that you asked me, I think my attitude toward the subject of government aid in medical care, which is presupposed by your questions, should be given. I am convinced that government should shoulder part and in some instances the whole of the expenses incurred by many families in the event of illness. The mechanism whereby this can be done and still have the family retain not only its own self-respect but a respect for the medical profession is difficult, but, I think, possible. It should be done with the approval of a great majority of physicians. This also is difficult, but, I believe, possible.

The indigent should be able to consult the physician of their own choice and the physician render the bill to the government. If a family has an income inadequate to pay extraordinary medical expenses, the government should aid them, but they themselves should bear some of the expense. If, however, they are in moderate or well-to-do economic circumstances, the government should be asked to aid them little, if any. It would not be difficult to state definitely who is in each group. How much income a family receives is an open book to the government and any family could obtain a card or some other identifying means to enable a physician to know whether they are to be fully or partially taken care of by the government. The expenses of such an undertaking would be minimal as compared with the all-inclusive health program proposed in the present legislation. Not only would this be less expensive, but it would preserve the personal contact with patients that the medical profession has always regarded, and rightly, with jealousy.

We are now seeing a group of children who have been taken care of at government expense during the first year of their lives. These children for the most part are from couples in the low-income group. Most of them would not have come to a specialist during this period had not the government paid their expenses. Now that the year is up, a large group of them are continuing to come to my office because, in my opinion, they have discovered that there is a value in being taken care of by a children's specialist. They have spread this feeling among their acquaintances in no way connected with the government's bounty and they have brought their children in for routine care. So rather than decreasing my regular fee-for-service practice, it has actually increased the group of those who seek my services.

In 1937, Dr. L. R. DeBuys* in his Presidential Address to the Academy summarized, from a questionnaire which he had sent to pediatricians, what he considered to be the future of Pediatrics. He did not paint a very reassuring future for our profession. However, since that address almost every mother has come to know what a pediatrician is and what is his value. I think this is in no small measure due to the fact that the government by means of the EMIC program has made "pediatrician" a word familiar to every mother, rich or poor. We have never been so busy as we are now. If we are as valuable as we think we are, this is a good thing not only for our profession, but for better care for children.

*DeBuys, L. R.: Whither, J. Pediat. 11: 409, 1937.

If there is no economic barrier to the use of a pediatrician, then there must be more of them, and they should be good. This is a problem adequately analyzed by Dr. Wilson* in a recent letter to the JOURNAL OF PEDIATRICS and to which I wholeheartedly subscribe. It can be solved, as he states, only by better and more pediatric instruction in medical schools and in hospitals. I am, however, convinced that medical education should be handled in the same way as medical care. If a candidate can demonstrate his ability to be a good physician, the government should remove all financial barriers. If he or his parents cannot or can only partially pay for his education, then the government should complete the financial requirements. I do not believe that it would be necessary for medical education to be entirely subsidized by the government, but it could be done by some such method as I have indicated for medical care.

The result in the first instance would be that all children whose parents desire it could have the advantage of qualified pediatricians. The result in the second instance would be that all students who would qualify as pediatricians would be educated whether or not they were financially prepared. Such a total program would not be as expensive as the proposed plan. Furthermore, the proposed legislation deals with the medical care of children almost exclusively, as Dr. Wilson points out. It ignores the fact that means must be provided to obtain more and better pediatricians if all children are to have adequate medical supervision.

Federal funds for child care should be given to the state with qualifications that the state use those funds meeting certain definite but broad requirements. These requirements are rightly the prerogative of the Federal agencies, for they are the source of the income. Requirements and restrictions should be arrived at with the approval of an advisory board. On an advisory board to the Federal agencies should be representatives of organized medicine, voluntary medical organizations, medical schools, lay organizations; but there should be a large group of practicing pediatricians who represent those who practice with this the sole qualification for their being on such an advisory body.

The state should disperse these funds to the communities, but also with restrictions. Each state has its peculiar problems and should be best qualified to meet the diversities presented. Federal funds should be given with an appreciation of the state differences. That type of committee which supervises the Federal dispersement of funds should be set up in the state and regulate the allocation of funds to the community.

The ultimate spending of the Federal funds is placed with the locality. What is undertaken here should be the result of a decision by a group similar to that described before. These local projects should have already been reviewed in the Federal and again in the state group. Not only should there be a flow of ideas from the Federal to the state to the community, but there should be a mechanism whereby there would be a similar flow from the community to the state to the Federal group.

You ask if there should be an advisory committee to each type of agency. I have indicated that I think this is essential. You further ask if I believe there should be a general advisory and a technical advisory committee. It seems to me that the end would best be served if there were a general advisory committee which would have on it subcommittees of a technical nature; for example, committees who inquire into the problems of medical education, special graduate education, hospitals, clinics, sanitation, housing, etc.

Sincerely yours,

PAUL W. BEAVEN, M.D.

Rochester, New York.

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Dear Dr. Park:

In reply to your letter regarding Federal aid in health services and medical care to children.—

The experience gained in the EMIC program is too valuable to be discarded and any future Federal aid might be based on the framework of this progress. The experience of the Children's Bureau should be utilized for Federal administration. It would seem logical,

*Wilson, James, L.: J. Pediat. 28: 231, 1946.

however, to have this Bureau function as an advisory and coordinating agency. Broad principles could and should be established by the Federal agency under which state agencies would operate. Certain of the principles should be mandatory; e.g., definition of specialty, minimum hospital standards, etc. Other principles should be advisory in nature. The individual states should have the authority to set up their own methods of administration, fee schedules, and policies. Local authorities should work under state authorities.

The technical advisory committees to both the Federal and state agencies should be made up of practicing physicians, with representatives from the health department and the welfare department. This committee should have liberal and authoritative representation on a general advisory committee which consists of representatives from all recognized agencies interested in child health and welfare.

I would then envision the program thus:

A Federal grant-in-aid to individual states administered by individual states with advisory function and coordination centered in the Children's Bureau; that the setup in the Children's Bureau be the result of cooperation between the executives of the Children's Bureau and a technical advisory committee, with the approval of the general advisory committee. The same plan operating in each state either through the existing maternity and infants department of the state health department or a special agency set up by the state for its administrations.

The present method of local administration of EMIC program through local health departments seems to me the most logical way to handle local claims.

Sincerely yours,

ARTHUR H. LONDON, JR., M.D.

Durham, North Carolina.

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Dear Dr. Park:

1. If Federal funds are made available to expand child health services and medical care, I would feel that the Federal agency should administer them on the basis of actual need for the individual state, or on a matched basis either on equal amounts, or a ratio as high as 3 to 1 dependent upon the financial resources of the state, rather than on the basis of infant and maternal mortality rates. A state might have a fairly low rate but be unable to meet the needs for such a program because of inadequate funds for a well-balanced medical care program. The Federal policy should be general and the regulations for the use of these funds should be made to fit the needs of the individual state. I also feel that the state and community should have some financial responsibility in order that they would have the feeling that they are an actual part of the program, rather than it is just another Federal project.

The funds allotted to the state should be under the administration of the already existing agency the Maternal and Child Health Division of the State Department of Health, rather than setting up a new agency for the handling of these funds. The funds raised at the local level could also be under this same mentioned division and coordinated into the state plan thereby making tax list and monies for health work with children available for state matching. The basis for matching money of these communities would be on their ability to raise money from the tax list and endowments given for health purposes. Communities with small tax lists but with actual needs existing should have a higher ratio for matching such as 3 to 1.

2. The local advisory committee, or "The Health Committee" as it is known in Vermont, should be composed of the selectmen, overseer of poor, health officer, members of the medical and dental professions, representatives of the various religious and fraternal organizations, and the Red Cross. The function of this committee, assisted by the public health nurses, is sponsorship of the program as set up by the state plan. They aid in educating the general public in the aims of the program, give assistance at medical conferences and, most impor-

tant of all, are responsible for getting money from the tax list at town meetings. The success of the program is their responsibility both in the local and state plan.

The state advisory committee should be composed of the leaders in the various state organizations who are interested in the health of the child such as State Medical and Dental Societies, State Department of Education and Welfare, Women's Clubs, State P. T. A., and other welfare organizations. Their function would be to assist the official agency in making general policies and plans for the program. They could be of great aid in obtaining funds from the state government by making known the demands for need for such a program of child health services.

The Federal advisory committee should be composed of professional and lay organizations at the national level, but with state representatives who know the state problems and reactions of the professional groups as they are very varied in the many states. Its function would be to make general policies and recommendations as the needs arise in relation to the health services, and long-range planning adjusted to the needs of the times.

3. The technical advisory committee, the function of which would be to establish medical policies and procedures, could best obtain their objectives if separated from the general committee but they should serve in a dual capacity as part of the general committee in order to obtain the viewpoint of the lay and professional groups.

PAUL D. CLARK, M.D.

Burlington, Vermont.

# Academy News

On June 22, Dr. Joseph S. Wall, Chairman of the Academy Committee on Legislation, appeared before the Senate Committee on Education and Labor, on behalf of the American Medical Association, which was holding hearings on the Pepper Bill (S. 1318). Dr. Wall submitted a statement which covered in large part the report of his Committee which was published in the JOURNAL last March (J. PEDIAT. 28: 364-372). To this he added the resolutions which were passed at the meeting of the Academy which were published on page 384, and the criticisms of the bill by Dr. Butler, which were approved by the Academy and were published on pages 390-391.

Dr. Stewart H. Clifford of Brookline, Massachusetts, has accepted the Chairmanship of the Committee on Fetus and Newborn, following the resignation of Dr. Ethel C. Dunham, of Washington, D. C.

Dr. James G. Hughes of Memphis, Tenn., has accepted the position of Chief Liaison Officer for The American Legion, following the resignation of Dr. Hugh McCulloch of St. Louis, Mo.

# News and Notes

Citation with the Bronze Star Medal was received by Lieutenant Harold A. Rosenberg, Waterbury, Conn., of the United States Naval Reserve. The citation was made "For meritorious services in connection with operations against the enemy as a medical officer attached to a Marine air base in the *Ryukyu Islands* area during the period April 5 to June 7, 1945. *Lieutenant Rosenberg*, laboring long hours under extremely adverse weather conditions and in areas which were daily subjected to enemy aerial assaults and shelling, maintained high standards of health and sanitation among the units based at the airfield served by his organization, thereby keeping epidemic diseases to a minimum and preserving the combat efficiency of personnel in the performance of the prodigious tasks which faced them during a particularly critical period of the *Okinawa* campaign. *Lieutenant Rosenberg* also rendered extremely valuable service in the treatment and evacuation of wounded personnel, frequently facing great danger in the performance of such duty. His courageous devotion to duty, tireless efforts and high professional skill contributed materially to the success of the *Okinawa* campaign and were in keeping with the highest traditions of the United States Naval Service."

The following Fellows of the Academy have been released from the Armed Services:

Dr. John B. Ahouse, Yonkers, N. Y.
Dr. Alexander J. Alexander, Lexington, Ky.
Dr. William Thomas Auld, Stockton, Calif.
Dr. James E. Bowman, Philadelphia, Pa.
Dr. John Dorsey Craig, New York, N. Y.
Dr. George L. Drennan, Jacksonville, Ill.
Dr. Ernest Ekermeyer, Tallahassee, Fla.
Dr. Frederick H. Fehlmann, San Diego, Calif.
Dr. Banice Feinberg, Providence, R. I.
Dr. Harry E. Gerner, Jersey City, N. J.

Dr. James B. Gillespie, Urbana, Ill.
Dr. A. Lawrence Gleason, Oakland, Calif.
Dr. Martin J. Harris, Louisville, Ky.
Dr. Howard M. Jacobs, Chicago, Ill.
Dr. Samuel Karelitz, New York, N. Y.
Dr. Willard Z. Kerman, Chicago, Ill.
Dr. Bertrand I. Krehbiel, Topeka, Kan.
Dr. William Wayne Lockwood, Spokane, Wash.
Dr. Selby V. Love, Louisville, Ky.
Dr. R. J. McGillicuddy, Lansing, Mich.
Dr. Alvah L. Newcomb, Winnetka, Ill.
Dr. Ralph E. Netzley, Pasadena, Calif.
Dr. William B. Nevius, East Orange, N. J.
Dr. E. Harrison Nickman, Atlantic City, N. J.
Dr. Roderick A. Norton, Tacoma, Wash.
Dr. Lyon N. Pearlman, Ottawa, Ont., Canada
Dr. Allan Ross, Montreal, Que., Canada
Dr. Eli Rubens, South Bend, Ind.
Dr. Noel G. Shaw, Evanston, Ill.
Dr. Matthew M. Steiner, Chicago, Ill.
Dr. Benjamin M. Spock, New York, N. Y.
Dr. James W. Stirling, Bellevue, Pittsburgh, Pa.
Dr. T. Durland Van Orden, New York, N. Y.
Dr. Alfred Weller, Arlington, Mass.
Dr. Arnold Widerman, Philadelphia, Pa.
Dr. A. Alvin Wolf, Chicago, Ill.
Dr. Carl Zelson, New York, N. Y.

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The following promotions have been reported to the JOURNAL:

*Army*

Captain Horst A. Agerty to Major.
Captain Clinton Hollister to Lieutenant Colonel.
First Lieutenant Edward B. Plattner to Captain.
Major Irving Rosenbaum, Jr., to Lieutenant Colonel.
Captain Thomas E. Shaffer to Major.

*Navy*

Commander Stanley V. Laub to Captain.

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*United States Public Health Service*

Dr. Carl Zelson has been promoted to Surgeon in the United States Public Health Service.

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The American Pediatric Society at its Fifty-sixth Annual Meeting at Skytop, Pa. on May 1 to 3 elected the following officers for 1946-1947:

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| President: | Dr. Harold K. Faber, San Francisco, Calif. |
| Vice-President: | Dr. Howard H. Mason, New York, N. Y. |
| Secretary-Treasurer: | Dr. Henry G. Poncher, 1819 W. Polk St., Chicago, Ill. |
| Recorder: | Dr. Stewart H. Clifford, Brookline, Mass. |
| New Member of the Council: | Dr. Joseph Stokes, Jr., Philadelphia, Pa. |

The following candidates were elected to active membership of the Society:

Dr. Russell John Blattner, St. Louis, Mo.
Dr. Paul Leo Boisvert, New Haven, Conn.

Dr. Charles Alderson Janeway, Boston, Mass.
Dr. Herbert Chauncey Miller, Jr., Kansas City, Kan.
Dr. Albert Bruce Sabin, Cincinnati, Ohio
Dr. Milton J. E. Senn, New York, N. Y.
Dr. Helen Brooke Taussig, Baltimore, Md.

The Society also received a sum of $15,000 from Mead Johnson and Company, Evansville, Ind., to be known as the "Mead Johnson Vitamin A Fund." Grants-in-aid from this fund will be used for research and studies in the field of fat soluble vitamins. A committee consisting of Dr. Edwards A. Park, Dr. Allan M. Butler, and Dr. Daniel C. Darrow was appointed to administer all grants-in-aid in connection with the use of funds. All applications for grants and correspondence should be addressed to Dr. Edwards A. Park, 601 N. Broadway, Baltimore 5, Md.

The new officers of the Society for Pediatric Research elected at the meeting at Skytop, Pa., April 30-May 1 are:

President: Dr. Mitchell I. Rubin, Buffalo, N. Y.
Secretary: Dr. Robert Ward, 477 First Avenue, New York 16, N. Y.

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Dr. Harold O. Ruh, Cleveland, Ohio, died from coronary thrombosis on May 18, 1946, at the age of 62.

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Dr. Murray B. Gordon, New York, N. Y., died June 29, 1946.

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MANUSCRIPTS INVITED FOR NORTON MEDICAL AWARD

The book publishing firm of W. W. Norton & Company, Inc., announce that they are again inviting manuscripts for submission to be considered for the Norton Medical Award of $3,500 offered to encourage the writing of books on medicine and the medical profession for the layman. The first such award was made to *The Doctor's Job*, Dr. Carl Binger's book, published last spring, which gave the doctor's point of view on his work. Announcement will be made shortly of the winning book for 1946. Closing date for submission of manuscripts this year is November 1, 1946. All particulars relating to requirements and terms may be had by addressing W. W. Norton & Company, Inc., 70 Fifth Avenue, New York 11, N. Y.

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FEDERAL SECURITY AGENCY

Washington, D. C.

Wednesday, July 17, 1946

With the reorganization of the Federal Security Agency going into effect yesterday, Federal Security Administrator Watson B. Miller today welcomed members of the United States Employees' Compensation Commission, the Children's Bureau and the Division of Vital Statistics, transferred to the Federal Security Agency by Reorganization Plan No. 2, and announced major changes in Agency organization and assignments of duty.

The Federal Security Agency, he stated, will be reconstituted under four main operating branches and six staff offices. The four branches are:

*Social Security Administration*—taking over the old-age and survivors' insurance, employment security, and public assistance programs formerly administered in the Agency by the Social Security Board, which was abolished by the Reorganization Plan, together with activities of the Children's Bureau, transferred from the Department of Labor.

Arthur J. Altmeyer, who has served as Chairman of the Social Security Board since February, 1937, has been appointed Commissioner for Social Security to head this new unit. Miss Katherine Lenroot, Chief of the Children's Bureau since November, 1934, will

continue in that post. No changes in the chiefs of the social security programs are contemplated.

*Education*—consisting of the existing Office of Education. The other educational functions of the Agency relating to the American Printing House for the Blind, Columbia Institution for the Deaf, and Howard University will be under the direction of the Commissioner of Education.

John W. Studebaker, Commissioner of Education since October, 1934, will continue to head this Office.

*Public Health*—consisting of the U. S. Public Health Service. Freedmen's and St. Elizabeth's Hospitals will be under the direction of the Surgeon General. The Division of Vital Statistics, transferred from the Department of Commerce, becomes part of the U. S. Public Health Service.

Thomas Parran, Surgeon General of the Public Health Service since April, 1936, will continue in this capacity. Halbert Dunn will remain as head of the Division of Vital Statistics.

*Office of Special Services*—a new office including the newly created Bureau of Employees' Compensation and the Employees' Compensation Appeals Board which succeed the U. S. Employees' Compensation Commission, abolished by Reorganization Plan No. 2; the Food and Drug Administration; and the Offices of Vocational Rehabilitation, War Property Distribution, and Community War Services.

Mrs. Jewell W. Swofford, Chairman of the U. S. Employees' Compensation Commission since July, 1933, has been appointed to direct this Office as Commissioner for Special Services. Senator Hattie Caraway, formerly a member of the U. S. Employees' Compensation Commission, will serve on the Employees' Compensation Appeals Board, which is established, in accordance with the Reorganization Plan, to hear and decide appeals of employees of the Federal and District of Columbia Governments.

In addition to these 4 operating branches, existing staff offices—Executive Assistant, General Counsel, Research, and Information—have been augmented by two new offices to provide for expanded functions of the Federal Security Agency.

*The Office of Federal-State Relations*—will be responsible to the administrator for study and recommendations in line with Section 10 of the Reorganization Plan. This provision looks toward the coordination of grant-in-aid administration and directs the Federal Security Administrator to establish, insofar as practical, uniform standards and procedures so that State agencies administering 2 or more grant programs may submit a single State plan, and be subject to unified fiscal, personnel, and other policies.

George E. Bigge, member of the Social Security Board since August, 1937, will head this Office.

*The Office of Inter-agency and International Relations*—will be responsible to the Administrator for formulating, establishing, and coordinating the Agency's relationships with other Federal agencies, international agencies, representatives of foreign Governments, and organized groups in the fields of health, education, welfare and social security.

Mrs. Ellen S. Woodward, member of the Social Security Board since December, 1938, will serve as Director of this Office.

With these additions, the Administrator's immediate staff, headed by Assistant Federal Security Administrator Maurice Collins, will remain substantially as at present constituted.

In making public the Agency's new organization, Mr. Miller paid a warm tribute to the units affected by the Reorganization Plan, and expressed his confidence that the changes now in process would not only simplify and improve administration but also promote their common purpose of health, education and security.

Commenting on the relationship of Children's Bureau programs to other services within the Agency, Mr. Miller stressed his concern, and that of the Agency as a whole, for the welfare of children and young people.

"We are very mindful," he said, "of youth's stake in all provisions for health, education and security—and of the Government's obligation to make adequate provisions to the end that all children and young people may get a good start in life. For administrative purposes, the Children's Bureau, with its programs for maternal and child health, child welfare, and crippled children's services, has been placed in the Social Security Administration. But its relationships with both health and education are fully recognized, and effective coordination in this field will be one of our major objectives. Studies will be inaugurated at once and maintained on a continuing basis, looking toward improvements in procedures and the strengthening of relationships.

"We are all," he pointed out, "public servants entrusted with the task of administering laws which Congress has passed in the interests of the general welfare. We have worked together in the past—because our jobs have thrown us together. Reorganization will strengthen the cooperation which we have already built up and open the way to 'combined operations' on a much broader front. As the President pointed out in his Reorganization Message, the further simplification of the Agency's 13 grant-in-aid programs represents a practical step toward improving both Federal and State administration. Since the Plan was made public in May, we have received expressions of warm approval from Governors and other State officials. We know that we can count on their cooperation, as they can on ours.

"We all realize," he continued, "that we have a big job and a big opportunity. We cannot do everything at once. But the path to continuing development has been cleared. We enter into our new relationships in a spirit of joint enterprise, of step-by-step exploration, study and progress in administering the health, education and social security measures with which this Agency is charged. For children, for the aged, for the handicapped, and for the people at large, we shall endeavor to make the most of the improvements now within reach."

When the Federal Security Agency was established by Plan No. 1 under the Reorganization Act of 1939, it brought together the Office of Education, the Public Health Service, the Social Security Board, the United States Employment Service (transferred during the war to the War Manpower Commission, and now in the Department of Labor), the Civilian Conservation Corps and the National Youth Administration (both of which have been terminated). Plan No. 2 under the same Act brought the American Printing House for the Blind into the Agency in 1940, and Plan No. 4 transferred to it the Food and Drug Administration, St. Elizabeth's Hospital, Freedmen's Hospital, Howard University and Columbia Institution for the Deaf. The Office of Vocational Rehabilitation was established in the Agency in 1943 to administer the expanded Federal-State civilian rehabilitation program under the Barden-LaFollette Act. The Office of Community War Services, now in liquidation, was developed during the war to implement the Federal Security Administrator's responsibility for coordinating emergency services in health, education, welfare, recreation, social protection and related fields. The Office of War Property Distribution was set up in 1945 to work with the War Assets Administration in facilitating the distribution of surplus property to health, education, welfare and other non-profit institutions having priorities under Section 13 of the Surplus Property Act.

In addition to transferring the functions of the Employees' Compensation Commission, the Children's Bureau (with the exception of its child labor functions which remain in the Department of Labor), and the Division of Vital Statistics to the Federal Security Agency, abolishing the 3-member Social Security Board, and providing for the coordination of grant-in-aid programs, the present reorganization includes the following changes:

Under Plan No. 2—

the functions of Assistant Commissioner of Education are transferred to the Office of Education to be performed under the direction of the Commissioner of Education;

the Federal Board of Vocational Education and the Board of Visitors of St. Elizabeth's Hospital are abolished;

functions with respect to the vending stand program for the blind are transferred from the Office of Education to the Federal Security Administrator; and will be administered under the Office of Vocational Rehabilitation;

Under Plan No. 3—

functions with respect to Army and Navy patients, formerly cared for at St. Elizabeth's Hospital, are transferred respectively to the Secretaries of War and Navy.

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U. S. DEPARTMENT OF LABOR
WASHINGTON 25, D. C.

July 16, 1946

## CHILDREN'S BUREAU INDUSTRIAL DIVISION MADE A PART OF LABOR DEPARTMENT'S DIVISION OF LABOR STANDARDS

Secretary of Labor L. B. Schwellenbach announced today that the Industrial Division of the Children's Bureau, which under the President's Reorganization Plan No. 2 remains in the Department of Labor while the rest of the Bureau moves to the Federal Security Agency, is being transferred as a unit to the Department's Division of Labor Standards.

In its new setting, the unit will be known as the Child Labor and Youth Employment Branch of the Division of Labor Standards. It will be directed by Beatrice McConnell who will be made an Assistant Director of this Division. Miss McConnell has been with the Children's Bureau since 1935, and has been the person responsible, under the Chief of the Children's Bureau, for the administration of the child-labor provisions of the Fair Labor Standards Act since its passage in 1938.

"I am transferring the Children's Bureau Industrial Division as a unit because I want the Department of Labor to continue its leadership in promoting the welfare of young workers, and this Division has behind it a notable record of achievement in this respect," Secretary Schwellenbach said. "In accordance with the terms of the Reorganization Plan, which transfers the Bureau's child-labor functions to my office, I am delegating these responsibilities to be performed by the new Child-Labor and Youth-Employment Branch in close relationship with the Department's Wage and Hour Division which administers the rest of the act."

In addition to these responsibilities, the new Branch will be expected to promote better working conditions for minors, develop and promote standards for their employment protection, and measures for advancing their opportunities for suitable work. It will advise with other bureaus in the Department and with State and other public and private agencies and with individuals on these and other matters affecting young workers. In these activities, the Branch will cooperate with the Children's Bureau work in the broad field of child health and welfare.

Miss McConnell, who is a graduate of the University of Wisconsin, has had wide and varied experience in the field of employment for women and children. For 10 years she served in the Bureau of Women and Children of the Pennsylvania Department of Labor and Industry, first as Assistant Director and later as Director. She served as a member of the Committee on Housing of Migratory Workers of President Roosevelt's Conference on Home Building and Home Ownership, and represented the State of Pennsylvania on the Interstate Migratory Child Labor Committee. She played an active part in the National Committee on Hazardous Occupations for Minors in 1932, and served as a member of the 1940 White House Conference on Children in a Democracy. Miss McConnell was appointed Technical Advisor of the U. S. Government Delegation to the International Labor Organization, meeting in June, 1937, in Geneva, and has served in a similar capacity at the ILO conferences held in Havana, Cuba, in 1939, and in Mexico City in April, 1946.

# Comment

On June 22 ten of the eleven members of the Editorial Board of the JOURNAL spent the day in St. Louis discussing JOURNAL policies and plans for the future. Only three of the present eleven members of the Board were members of the original Board appointed by the Academy in 1932.

From both the editorial and publishing standpoints the war brought many problems to the JOURNAL which are just now beginning to straighten out.

Certain specific changes were decided upon which are of importance to authors submitting manuscripts for publication and to JOURNAL readers.

1. In the future the metric system for weights and for doses of drugs will be used in the text corresponding to the usage in the *U. S. Pharmacopoeia.*

2. References to literature should include the title of the article as well as the numerical reference to the volume, page, and year of the journal.

3. Titles to articles should have the term used in *The Quarterly Cumulative Index of Medicine.* Thus for example, use Poliomyelitis, not Infantile Paralysis; Whooping Cough, rather than Pertussis.

The JOURNAL will continue its past policy of broad coverage of the entire field of pediatrics. The return of pediatricians from service and the deceleration of the teaching in our medical schools and clinics, should relieve the shortage of and strain on the personnel in our hospitals and clinics and lead to pediatric research going ahead again as it did during the late thirties. The JOURNAL publishes approximately 150 articles a year. In 1940, 270 manuscripts were submitted for publication allowing a wide choice in selection by the Editorial Board. By 1944 the number submitted fell to 136. A marked increase has taken place in the first half of the present year. The situation during the war was not in any way unique for the JOURNAL but affected all medical publications.